Math I-2&3

Activities

Explain Relationships

Specialty Cakes

Standard I:

Students will expand number sense to include integers and perform operations with whole numbers, simple fractions, and decimals.

Objective 2:

Explain relationships and equivalencies among integers, fractions, decimals, and percents.

Intended Learning Outcomes:

2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.
4. Communicate mathematical ideas and arguments coherently to peers teachers, and others using the precise language and notation of mathematics.

Content Connections:

Math I-1&2; Fractions/ Equivalencies

Math Standard I

Objective 2

Connections

Background Information

On day one of this activity students will construct a large triangle cake using various geometric shapes. They will find both the fractional value of each piece as well as the total cost of the cake. The students will construct a large equilateral triangle. An equilateral triangle is a triangle where the angles are the same and the sides are the same length. This equilateral triangle will be made up of 2 of each of the following pattern block shapes: trapezoid (4 sided object with 1 pair of parallel lines, regular hexagon (6 sided object), parallelogram (2 pairs of parallel lines) and 3 small equilateral triangle (all sides are the same size). Each different shape is associated with a different type of cake.

Each cake has a different value. Equilateral Triangle is chocolate mint and has a value of $.50. Trapezoid is a strawberry cake and has a value of $1.00. Parallelograms are blueberry flavored and have a value of $.75. Hexagon is a lemon cake and has the value of $1.75. During the first day of the activity the students will build their cake based on specific instructions. On the second day the students will build the most economical cake.

Students then use cost associated with the pieces to find the cost of their Specialty Cake and their Bargain Cake. Students will also make the fractional connection of each of the pieces and find that the basic unit of the fraction is the small equilateral triangle. Based on breaking the large triangle into equal parts of the equilateral triangle, each small equilateral triangle will represent 1/25 of the whole.

Students will have an opportunity to find that each of the shapes used can be made up of the smallest unit (equilateral triangle). The students will discover that it is less expensive to use the biggest pieces possible on the second day.

Research Basis

Simon, M.A., Tzur, R. (2004). Explicating the role of mathematical task in conceptual learning: An elaboration of the hypothetical learning trajectory. *Mathematical Thinking and Learning 6,(2),*91-104.

This article focuses on the need of worthwhile tasks and the value that comes in mathematical understanding when they students are given appropriate opportunities to develop their mathematical understanding. Simon went on to say:

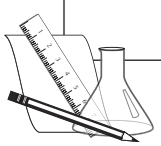
This emphasis is based on the idea that if students are challenged at an appropriate level with non-routine tasks, they develop their cognitive abilities and engage in rich mathematical conversations. Indeed if more time were spent in classrooms with students engaged in working on cognitively demanding non-routine tasks, as opposed to exercises in which a known procedure is practiced, students' opportunities for thinking and learning would likely be enhanced (p.92).

Charles, K., Nason, R., & Cooper, T. (1999). Mathematical analogs and the teaching of fractions. ERIC # ED469872. Retrieved December 31, 2007 from http://eric.ed.gov.

In this study, 3rd grade students were given 30 facilitated activities where they focused on three factors: ecological validity for the children, abstraction ability encompassing the quality and the quantity of interrelated tasks and the quality of portioning strategies and finally the ease of partitioning. Results suggested that for the activities used in this study to be educationally effective in teaching partitive quotient fractions, teachers need to address all 3 factors.

Materials

- ❑ *Utah Bakery Cakes*
- ❑ *Specialty Cake Template*
- ❑ *Bargain Cake Template*
- ❑ Overhead pattern blocks
- ❑ Pattern blocks manipulatives
- ❑ Blank transparencies
- ❑ Markers
- ❑ *Cook-A-Doodle Doo!*



Invitation to Learn

Invite your students to think of a time when they saw or had a very fancy cake. What do they remember about the cake? Tell the students that they are going to be working for a fancy cake bakery called Utah Bakery Cakes. They will be designing their own specialty cakes. Ask the students to discuss with their table the types of things that they would like to see on their cakes. If time allows ask them to sketch some of their ideas. You could share the book *Cook-A-Doodle Doo!* by Susan Crummel to help build background information.

Instructional Procedures

Day 1:

1. Divide the students into partners, and then hand out the pattern blocks and *Utah Bakery Cakes*, and *Specialty Cake Template* (one per student).
2. Ask the students to make a pile of the 4 different shapes: equilateral triangle, parallelogram, trapezoid, and hexagon. Once they have pulled out the correct shapes, ask the students to construct the specialty cake.
3. Read or have the students read over the *Utah Bakery Cakes* to find the information about their cakes. They are only completing #1 on this paper.
4. Remind them that the specialty cake is made up of at least 2 of each of the different shapes or at least 2 of each of the different kind of cakes.
5. Have students begin to construct their specialty cake. As the students are working on their cake wander around to hear what struggles and what celebrations the students are having.
6. As the students complete their specialty cake on their *Specialty Cake Template* have them trace each of the geometric pieces in their large triangle.
7. As you are monitoring the students' progress, invite the students to find the shape that fits in all of the other pieces. The common piece is the tool to find the fractional value of each piece.
8. Students now find the fractional part of the different types of cakes. Now invite the students to write a paragraph (on the bottom of *Specialty Cake Template)* outlining how they came to their conclusion, what was difficult about the activity and what was easy. What patterns did they see with the different geometric parts? Also, ask them to include any mathematical connections they might have to this activity.
9. As the partners both complete their own writing on the *Specialty Cake Template* give each group one transparency and an overhead marker to recreate their own "specialty cake" to share with the class.
10. For those students who quickly finish, ask them to find the cost of the cake. If time allows provide them with another *Specialty*

Cake Template to see if it is possible that their specialty cake looks different. (Average value of gourmet cake is $8.50)

11. Once all the students have constructed their specialty cakes and are ready to share, ask each group to come up and share how they figured out their cake, and what patterns they noticed.
12. When all the groups have shared, ask the students to draw connections between the positioning of the pattern blocks, what was similar between most solutions, and what differences they noticed between the solutions. Invite them to share something they noticed with the geometric parts or fractions they noticed.
13. For those students who were asked to find the cost of the specialty cake, have them share the cost of the specialty cake.
14. Gather the *Specialty Cake Template* and *Utah Bakery Cakes* from the students, which can be used as an assessment on their mathematical thinking as well as an insight to the struggles of the students.

Day 2:

15. Review the previous day's activities by reading a couple of paragraphs written by the students the previous day, talking about their experience with the specialty cakes.
16. Have the students get with their partner from the day before and hand out the pattern blocks, return their *Utah Bakery Cakes,* and hand out the *Bargain Cake Template*.
17. Students are to complete the 2nd task of creating the bargain cake.
18. Monitor and observe as the students are constructing their cakes. Have them follow the same routine as day one. Once their triangle is constructed, ask them to find the value of the bargain cake. (Note: if the value is not $8.00 they need to try again).
19. While the students are working in small groups, look for groups that realize that all of the pieces can be made using the small equilateral triangle. The trapezoid is made up of 3 small equilateral triangles. The parallelogram is made up of two of the small equilateral triangles and the hexagon is made up of 6 of the small triangles. This will be the springboard for the conversation at the end of the lesson. If the students are struggling, ask them how they could make the shape of a lemon

cake without using the hexagon. (You can repeat this process with the different pieces).

20. Once they have their bargain cake completed ask them to trace the geometric shapes on their *Bargain Cake Template.* They will then trace their solution on a transparency.
21. Have the students find the fractional parts of the cake.
22. Once all or the majority of the class has completed the second cake ask for the teams to share.
23. Invite the students to look for similarities and differences in how students figured out the economical cake.
24. Invite the students to write a paragraph(on the bottom of *Bargain Cake Template)* outlining how they came to their conclusion, what was difficult about the activity and what was easy. What patterns did they see with the geometric parts? Also ask them to include any mathematical connections thy might have to this activity.
25. Lead a discussion about equivalent shapes and how the students determined whether it was better to use the smaller shapes or the larger shapes.

Assessment Suggestions

- Anecdotal Notes / Observation: Using a clipboard and sticky notes document your students' mathematical thinking. Use a checkmark plus, checkmark, or a checkmark minus to show whether students are reaching the benchmark,
- Review student's paragraphs on *Specialty Cake Template,* and *Bargain Cake Template.*
- Informal Observation/ Interviews: Prepare questions to find out their mathematical thinking

Curriculum Extensions/Adaptations/ Integration

- Ask your fast finishers to find the decimal part of each of the shapes, the fractional part, and the percentage of each different shape.

- For your learners with special needs, partner them with a competent students that can help them construct their triangle. Provide a template with some of the pieces already in place. Have them tell you what they did so solve the problem and then either write it down for them, or accept their explanation for their assessment.
- Social Studies and George Washington 40 egg cake,
- Science with physical and chemical change

Family Connections

- As a homework assignment or extra credit Have the students and parents cook or bake something that requires using fractions.
- Have the parents and students come up with 10 different ways they use fractions in their house.

Additional Resources

Books

Cook-A-Doodle Doo!, by Susan Crummel; ISBN 0152056580

Great Cake Bake, by Helen Ketteman; ISBN 0802789501

Web sites

http://www.thefutureschannel.com/dockets/realworld/the_bakery/

http://www.foodnetwork.com/

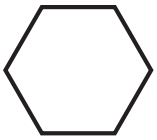
Organizations

Northwest Regional Education Laboratory, http://www.nwrel.org/index.php

Utah Bakery Cakes

Here's something to think about . . .

The
Utah Bakery has
come up with THE COOLEST specialty
cakes. They're triangular cakes.
Each triangular cake is made up of pieces with various flavors.
Every flavor is cut up in a different shape so the bakers can tell them apart.
Each flavor costs a different amount too. These are the shapes and their flavors:

Chocolate Mint 	**Strawberry** 
Blueberry 	**Lemon** 

1. For the triangular Specialty Cake the bakery includes at least two pieces of each kind of cake. It is the smallest cake you can make with at least 2 pieces of each kind of cake. Can you find a way to do that? What fractional value do each of the geometric shapes have? (Day #1)
2. For the Bargain Cake, they make a triangular cake (the same size as the specialty cake) as inexpensively as possible. The costs for the different flavors of cake are in the table below. What's the least expensive cake Utah Bakery can make?

$.50 Chocolate Mint	$1.00 Strawberry
$ .75 Blueberry	$1.75 Lemon

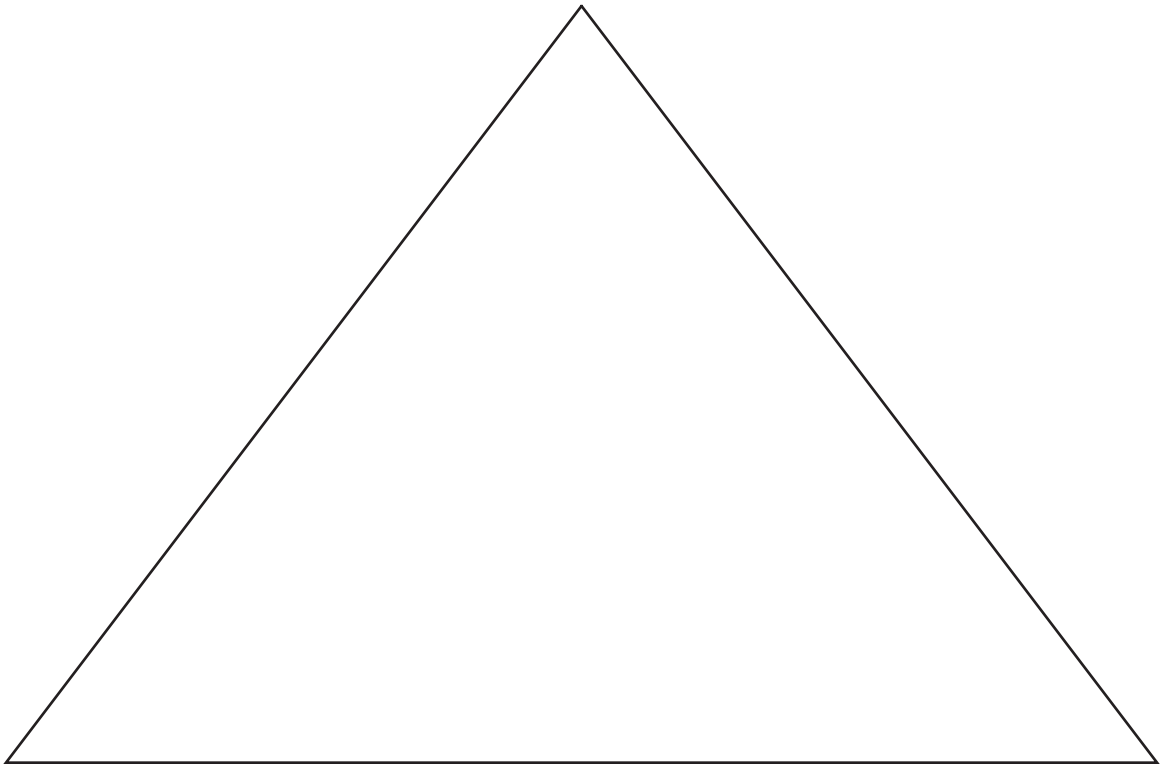
For each cake:

- Draw your design.
- Write a paragraph below your design explaining in detail the process you used and how you decided which pieces to use and well as what fractional value each geometric shape has. What patterns did you notices.

Name _____ Date _____

Specialty Cake Template

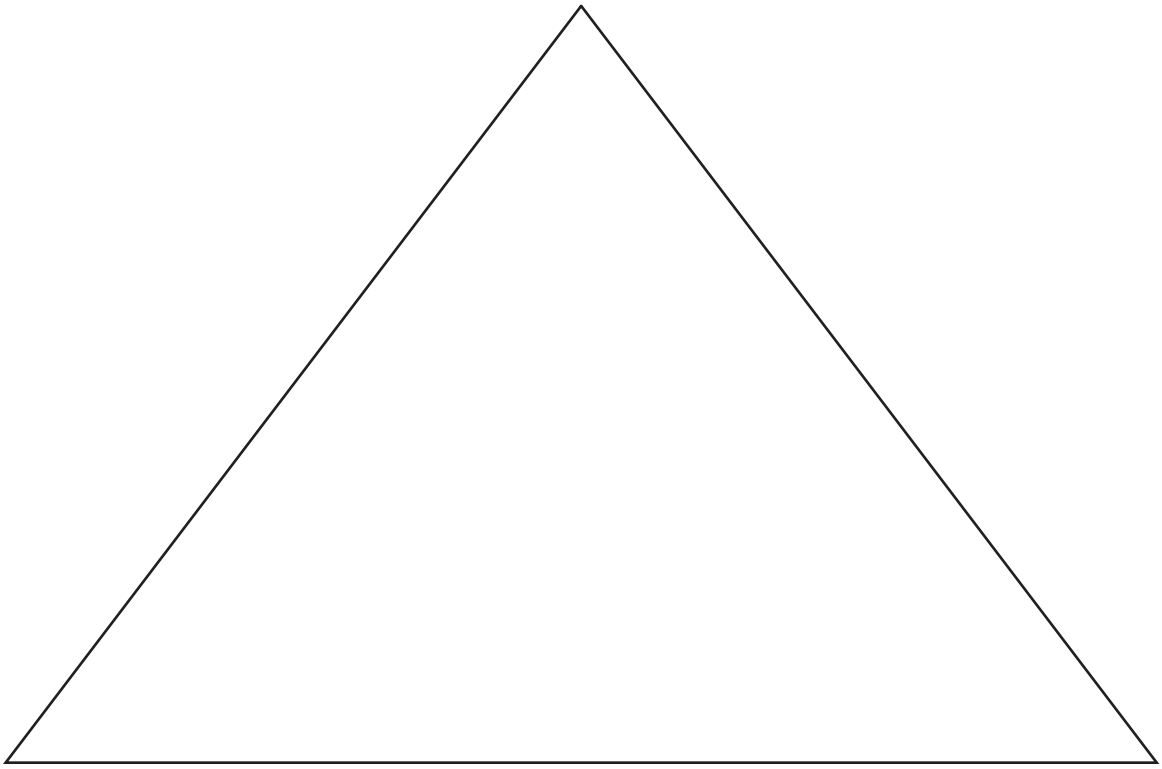
1. Design for the Specialty Cake (with at least two pieces of each kind of cake).



Name _____ Date _____

Bargain Cake Template

1. Design for the Bargain Cake (With at least two pieces of each kind of cake).



Parts of a Dozen

Standard I:

Students will expand number sense to include integers and perform operations with whole numbers, simple fractions, and decimals.

Objective 2:

Explain the relationships and equivalencies among integers, fractions, decimals, and percents.

Intended Learning Outcomes:

2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.
3. Reason logically, using inductive and deductive strategies and justify conclusions.

Content Connections:

Math I-2; Relationships and Equivalencies

Math Standard I

Objective 2

Connections

Background Information

In this activity, students will use the whole of an egg carton to manipulate the denominator by sectioning off the egg carton. A fraction is generally known as either a whole that has been divided up into sections, or a set that is divided into groups. With this activity we will be working with a whole. One egg carton that is divided up into 12 sections. Note if you were dealing with the eggs instead of the egg carton, you would be dealing with a set of objects. Students will use the vocabulary of numerator and denominator as they explore the different ways that a dozen-egg carton can be divided up into parts.

A numerator is the number above the line in a fraction. It also denotes the number of parts out of the whole that are being identified or used. A denominator is the number below the line in a fraction. This denotes how many parts the whole is divided into. Equivalent fractions are two fractions that express the same part of a whole. There is a number by which both the numerator and denominator of one fraction can be multiplied or divided to yield an equivalent fraction. 1/4, 2/8, and 3/12 are all equivalent fractions.

It is important to remember that groups do not have to be in the same shape in order for them to make equal parts. Students will use string to show the different ways that the egg carton can be divided up into. They include halves, thirds, fourths , sixths and twelfths.

Research Basis

Sowell, E. (1989). Effects of Manipulative Materials in Mathematics Instruction. *Journal for Research in Mathematics Education*. 20(5) 498-505.

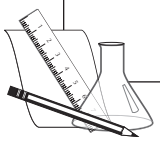
This report takes the results of 60 different studies to find what the effects are in a classroom where the teacher uses concrete/ pictorial manipulative instead of simply using the abstract ideas of mathematics. The study came to the conclusion that they greatest lasting results come from teachers who are constantly using concrete/ pictorial manipulative in their classroom. The benefit came when the manipulatives were used for a period greater than one year.

Clarke, D.M., Roche, A., & Mitchell, A. (2008). Ten practical tips for making fractions come alive and make sense. *Mathematics Teaching in the Middle School*. 13 (7) 372-380.

In this article the authors outline ten ideas for helping fractions to come alive in your classroom. One of their points included the idea that teachers need to provide a variety of models to represent fractions. If we as teachers expect our students to function fluidly with their understanding of fractions we need to provide opportunities for the students to represent and use different models.

Materials

- ❑ Dozen Egg Carton
- ❑ String
- ❑ Journal
- ❑ Counters
- ❑ *Parts of a Dozen*
- ❑ *Egg Carton Transparency*



Invitation to Learn

Ask the students/ teachers to answer the following questions using the sticky notes on their desks.

Questions you could ask students:

1. Write your name on a sticky note and place it on the first poster (this will give us the denominator).
2. If you have more than 5 siblings place a sticky note on poster number 2.
3. If you have 2-4 siblings place your sticky note on poster number 3.

4. If you are an only child place your sticky note on poster number 4.
5. If you have played a video game in the past week put a sticky note on the fifth poster.
6. If you ate breakfast this morning put your last sticky note on poster number 6.

Using the information gathered from the class, quickly talk about fractions created from the posters. Talk about what poster #1 tells us,

Instructional Procedures

1. Review background information and talk about some common fractions students use regularly in their life. Ask them what they know about dozens. What are some things that are purchased in a dozen?
2. Tell them we are going to use a common dozen around the home: eggs. Actually we're not using the eggs, but rather the egg carton.
3. Hand out one egg carton per student, 12 counters, and string. They will need 12, 12" pieces of string.
4. Hand out a half sheet of paper with different equivalent fractions, *Parts of a Dozen*.
5. Remind them of the vocabulary of denominators and numerators; what does each of them tell you? Today we are going to focus on the denominators of the fractions. Ask them to begin with #1 on their *Parts of a Dozen* page. If needed, remind them to look at the denominator to find out how many sections they need to have in their dozen. What does the one in 1/3 say? What does the 3 say? Using *Egg Carton Transparency* have a student model how to divide the egg carton into the number of parts as outlined by the denominator. The student will make three equal parts.

6. Now ask the students what does the 1 in 1/3 represent? Determine if the students know the difference between one cup of the egg carton, and the one part of the three parts. Once the students understand that difference, invite another student to come up and fill in what the 1 in 1/3 represents with counters. There should be 4 counters in the egg carton. Have the students fill in their first response and then have the students continue with the rest of their fractions.
7. Remind them that for each fraction they need to create the correct number of sections as in the denominator.
8. Once they have completed their *Parts of a Dozen* page have them sort their fractions based on the number of counters in each different fraction in their journal. They can write the numbers from 1 through 12, and then write down all the fractions that gave them that number of counters or they could circle the fractions with the same number of counters with the same color of crayon or marker. As the students begin to make the connections between the fractions introduce or reintroduce (depending on your classroom) the term equivalent fractions.
9. Below where they sorted their fractions, invite the students to glue their *Parts of a Dozen* into their journal and write a paragraph using the following vocabulary words. Numerator, denominator, and equivalent fractions. Invite them to explain what patterns they saw while working with their different fractions.
10. As the students are completing this task find different strategies from the student to share as a summary debrief. Also ask a couple of the students to read their paragraphs, or ask if you can read their paragraph for them.

Assessment Suggestions

- Anecdotal Notes.
- Students' journals, writing and a rubric to check their benchmark understanding of numerator, denominator, and equivalent fractions.
- Quick 3-problem check to see if they can still find the number of counters in their parts of a dozen. (Check to see if the students have reached their benchmarks.)

Curriculum Extensions/Adaptations/ Integration

- Ask your students who have mastered the benchmark to begin solving multiplying fractions in a similar method. Asking what is ½ of 12 they can begin to see a concrete model of multiplication and division with fractions.
- For your students who have not reached the benchmark, provide them with other similar problems, have them work with buddies.
- Equivalent fractions are everywhere—use data analysis technology integration to chart the results
- Use more than one egg carton to find mixed numbers and improper fractions.

Family Connections

- Have the students find other items that come in dozens. Invite the student and their families to construct a list of the different everyday items that are sold in dozens.
- Ask the students to find the fractions in their families. The number of boys to the total, girls to the total, kids to the total or adults to the total. Ask them to go a little further, with the number of boys compared to the total number of family member or girls compared to the total number of family members. Have the students write about the fractions that they found in their family in their math journal. This data could be used later to graph their family.

Additional Resources

Books

Jump, Kangaroo, Jump, by Stuart J. Murphy; ISBN 0060276142

Web sites

http://www.thefutureschannel.com/dockets/realworld/the_rhythm_track/

http://nlvm.usu.edu/

http://illuminations.nctm.org/

Parts of the Class

1. Write your name on a sticky note and place it on the first poster. This will give us the denominator.

2. If you have more than 5 siblings, place a sticky note on poster number 2.

3. If you have 2-4 siblings, place your sticky note on poster number 3.

4. If you are an only child, place your sticky note on poster number 4.

5. If you have played a video game in the past week put a sticky note on the fifth poster.

6. If you ate breakfast this morning, put your last sticky note on poster number 6.

Name _____ Date _____

Parts of a Dozen

1/3 = _____ 1/6 = _____

2/6 = _____ 2/3 = _____

1/2 = _____ 3/12 = _____

4/12 = _____ 9/12 = _____

8/12 =_____ 2/4 = _____

3/6 = _____ 4/6 = _____

1/4 = _____ 6/12 = _____

2/12 = _____ 3/4 = _____

Name _____ Date _____

Parts of a Dozen

1/3 = _____ 1/6 = _____

2/6 = _____ 2/3 = _____

1/2 = _____ 3/12 = _____

4/12 = _____ 9/12 = _____

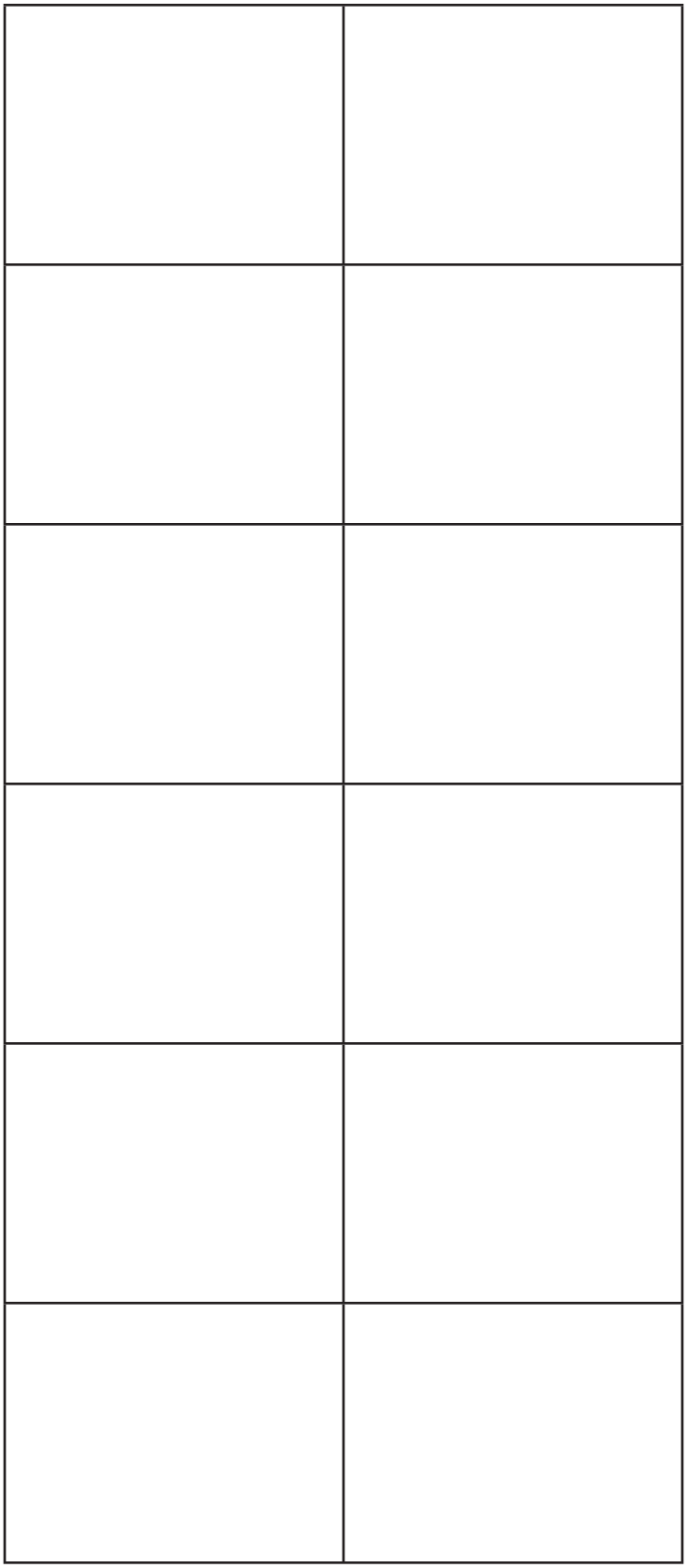
8/12 =_____ 2/4 = _____

3/6 = _____ 4/6 = _____

1/4 = _____ 6/12 = _____

2/12 = _____ 3/4 = _____

Egg Carton Transparency



Math I-3,4&6

Activities

Theory & Application

Rice and More Rice

Standard I:

Students will expand number sense to include integers and perform operations with whole numbers, simple fractions, and decimals.

Objective 4:

Model and illustrate meanings of multiplication and division.

Objective 6:

Demonstrate proficiency with multiplication and division of whole numbers and compute problems involving addition, subtraction, and multiplication of decimals and fractions.

Intended Learning Outcomes:

2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.

Content Connections:

Math IV-1; Area of polygons.
Language Arts VII-1; Comprehension of text

Math Standard I

Objectives 4 & 6

Connections

Background Information

Traditionally, teaching multiplication to students has emphasized memorization of multiplication facts and developing computational skills. These activities allow students to develop a more active approach to learning and developing a greater understanding of multiplication.

Students often do not possess number sense when looking at the relations of factors and products. The following activities help students develop number sense, discover what happens to the product when factors are doubled, and understand the properties of multiplying by factors of 10/100/1000. As students complete the activities, patterns will appear that encourage students to develop their own understanding of how multi-digit multiplication works. As students develop their own understanding of simpler related problems they will also develop strategies to solve more complex problems based on their foundational knowledge. Students need to be able to see, at the end of the lesson, the concept that when a factor doubles, the product doubles. On the flip side, the lesson can be extended to help students see that halving a factor also halves the product. Developing mental math skills is a strong byproduct of this lesson.

In order to make this lesson successful and worthwhile, teachers need to be comfortable with the teaching method of silence and allow students time to process and then later express their thoughts and ideas. When a red light is posted, there is no speaking. Gesturing and note writing can occur by students and teacher but no voice. Only when the green light is posted can verbal communication occur. This is a method that can work effectively in other curriculum areas when you desire to have the students discover the lesson. These activities are broken down into a two/three day lesson depending on the abilities and strategies of the students.

For the final activity, you must determine the number of grains within the jar based on 1783 grains of rice per a 1 oz medicine cup. Answers will vary depending on the size of jar and number of scoops necessary to fill it.

Research Basis

Baek, J.M. (2006). Children's Mathematical Understanding and Invented Strategies for Multidigit Multiplication. *Teaching Children Mathematics*. 12(5) 242-247.

Research was conducted with fourth grade students showing students who demonstrate flexibility in the methods chosen to perform computational multiplication understand and can explain chosen methods. Strategies that students develop themselves become a window to explore their understanding of multiplication.

Brandenburg, M.L. (2002). Advanced Math? Write! *Educational Leadership*. 60(3) 67-68.

This article examines one teacher's attempt to incorporate journal writing into the mathematics curriculum. Her discoveries included encouraging others to start small, develop a rubric and realize that you will learn as much about student learning, through journal writings, as the students did.

Invitation to Learn

Place before the students a jar filled with rice (which has been counted beforehand). Ask each student to make a guess as to the number of grains of rice in the jar. Have students record their guess and explain their thinking behind their guess in their journal. Post the movement chart and have students perform the physical action corresponding to their guess. Students will group themselves and discuss methods for determining their guess. Bring the class back together and allow them the opportunity to share strategies. Do not share the correct answer at this point, only strategies. The correct answer will be shared at the end of the lesson.

Instructional Procedures

Materials

- ❑ *One Grain, Two Grains, Four Grains…*
- ❑ 1 red 6" circle,
- ❑ 1 green 6" circle
- ❑ Overhead base 10 manipulatives
- ❑ *One Grain of Rice*
- ❑ 6 jars, same size
- ❑ Rice, small grain
- ❑ 5- 1oz medicine cups

Day 1:

1. Red Light/Green Light - Explain to the students when the red light is posted there is no verbal communication. Only when the red light has been removed and the green light posted will students be allowed to speak. This is important to allow all students a chance to learn from the activity and develop their own thinking.
2. Show students the three signals used to respond during the game. Thumb up means they know or agree with the answer, thumb sideways means they are unsure, and thumb down means they do not know or disagree with the answer.
3. When everyone understands the first two steps, begin the activity. Post the red light on the board so all can see it. Write the problem 1 x 3 on the board. Students will indicate they know the answer with their thumb. Hand a marker to a student indicating they know the answer and have them write the answer on the board. All students will then indicate their response with a thumb.
4. Write a second related problem (for example, 2 x 3) on the board under the first and allow students to respond when they know the answer. Hand a marker to a student to write the answer. Have the rest of the class respond with thumbs.
5. Post the green light and lead a discussion as to how the first two problems are related. What can they use from the first problem to help them solve the second problem? What do they see happening?
6. Post the red light and continue the round with 4 x 3, 8 x 3, 16 x 3 and 32 x 3. Post the green light and allow students to verbally share insights. Direct discussion toward developing some predictions about the pattern evolving. Also show students that they may feel they are not challenged with 4 x 3 but do they mentally know 16 x 3?
7. Use arrays to show the process for students having trouble discovering the patterns. The visual cues help students to picture what is happening, also tying in underlying concepts of area. Students can be provided manipulatives at their desk to aid them if needed.
8. Continue to practice and discuss other sets of problems for students to develop skills of doubling. Students need to discover that when a factor doubles, the product doubles. Other sets to work with are:

Doubling 1 factor	Halving and doubling	Changing factors
3 x 4	2 x 6	2 x 6
6 x 4	2 x 12	2 x 12
12 x 4	4 x 12	4 x 12
24 x 4	4 x 6	8 x 12
24 x 8	8 x 6	16 x12

With continued practice, students recognize that when a factor doubles, the product doubles. On the flip side, when a factor halves, a product halves. Students become more confident in multiplication and specifically their ability to easily multiply both on paper and mentally.

Day 2:

9. After reviewing the lesson of the previous day and the strategies students discovered, write 2 x 1, then 2 x 10, then post green light and allow discussion. Post the red light and continue with 4 x 10, 7 x 10, 11 x 10, 15 x 10, 22 x 10, and 34 x 10. Post green light and discuss as necessary. Extend to include a factor of 100 until students understand the multiplication pattern of 10/100/1000's.
10. Have students write strategies and understanding of multiplication in their journal.

Day 3:

11. Read the book *One Grain of Rice* to class.
12. As you read the book, have students begin to fill out worksheet *One Grain, Two Grains, Four Grains…*
13. Discuss the strategies that students used to complete the worksheet.

Assessment Suggestions

- Provide each group with a jar, rice and a scoop. Inform students that there are 1783 grains of rice in a scoop. Allow groups to develop their own strategy for determining the amount of rice in the jar. Students will then write about their process and findings in their journal. Share findings and compare to predictions made on the first day.
- During the lesson, have students write in their journal expressing ideas and learning.
- Give a word problem for students to solve. Ask students to solve the problem in as many different ways as they can and explain why their answers make sense.

- Give students a set of similar problems to solve, similar to sets done during the lesson.

Curriculum Extensions/Adaptations/ Integration

- Allow differentiation by using the red light/green light concept in small groups. One student writes the beginning problem passing the paper to the next. The next student answers the first problem and then writes a related problem, passing the paper to the next person. The next person checks the answer of the previous, writes answer and passes paper. Activity continues with children checking, answering and writing related problems.
- Vary the green light times by having students share their findings with a partner or write ideas in their journal and then share.
- Extend learning by providing sets that put the commutative property into work.
- Extend the lesson by teaching through sets of problems to not only double the product but also to halve factors and thus halve the product.
- Special needs students and those with a weak knowledge of multiplication facts can become proficient at multiplication with practice using the doubling concepts.

Family Connections

- Make a take home lesson kit. Allow students to take the jar, rice and scoop home and have parents determine the amount of rice in the jar, sharing their strategies with their child.
- Give a homework assignment to develop a set of problems to practice the skills learned.
- Have students find a quantity item in the home and write a strategy for determining the amount present.

Additional Resources

Books

About Teaching Mathematics, A K-8 Resource, by Marilyn Burns; ISBN 978-0-941355-76-6

Lessons for Extending Multiplication, by MaryAnn Wickett; ISBN 978-0-941255-31-5

One Grain, Two Grains, Four Grains...

As you listen to the story, try to use the doubling strategy to complete the following chart to determine the amount of rice Rani received each day.

Day 1 **1** grain of rice	Day 2 **2** grains of rice	Day 3 **4** grains of rice	Day 4 _____ grains of rice
Day 5 **16** grains of rice	Day 6 ____ grains of rice	Day 7 ____ grains of rice	Day 8 **128** grains of rice
Day 9 **256** grains of rice	Day 10 ____ grains of rice	Day 11 ____ grains of rice	Day 12 **2048** grains of rice
Day 13 **4096** grains of rice	Day 14 **8,192** grains of rice	Day 15 _____ grains of rice	Day 16 **32,786** grains of rice
Day 17 _____ grains of rice	Day 18 _____ grains of rice	Day 19 **262,144** grains of rice	Day 20 _____ grains of rice
Day 21 **1,048,576** grains of rice	Day 22 **2,097,152** grains of rice	Day 23 _____ grains of rice	Day 24 _____ grains of rice
Day 25 **16,777,216** grains of rice	Day 26 _____ grains of rice	Day 27 **67,108,864** grains of rice	Day 28 _____ grains of rice
Day 29 _____ grains of rice	Day 30 **536,870,912** grains of rice	Day 33 Extra Credit _____ grains of rice	Day 35 Extra Credit _____ grains of rice

Mystery Dinner

Standard I:

Students will expand number sense to include integers and perform operations with whole numbers, simple fractions, and decimals.

Objective 4:

Model and illustrate meanings of multiplication and division.

Objective 6:

Demonstrate proficiency with multiplication and division of whole numbers and compute problems involving addition, subtraction, and multiplication of decimals and fractions.

Intended Learning Outcomes:

1. Develop a positive learning attitude toward mathematics.
3. Reason logically, using inductive and deductive strategies and justify conclusions.
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.

Content Connections:

Math I-3; Divisibility concepts

Math Standard I

Objective 4 & 6

Connections

Background Information

These activities help to develop a student's abilities in understanding the type of division of sharing objects equally as compared to dividing objects into groups of a known size. By completing the sharing activity, students can then relate the information into the standard symbolic representations.

Before beginning the activity, materials must be gathered so that each group has a set of courses. Classes can be arranged into groups of 12. Within the group, students will work in pairs so one group has 6 pairs. This way, each pair will be working one course and a bell can serve as a signal to switch to a new course. Student's only knowledge should be an understanding of what it means to share equally. They must also understand the term remainder or leftovers for this activity. As students complete the activity, teachers must be aware of clean up and keep students aware also to prevent the loss of items, thus changing the results from pair to pair.

The two division games are ways to encourage students to use mental math, practice math facts and develop number sense in terms of relating division to other operations. Several variations may be used for each game after the students have become familiar with the structure of the game. These activities also serve as good center activities and can be utilized in that manner once the games have been

taught within the whole class. Division tiles are self-checking and thus eliminate the need for the teacher to verify student work. No Remainder reinforces the rules of divisibility also.

Research Basis

Gregg, J. & Underwood Gregg, D. (2007). Interpreting the Standard Division Algorithm in a "Candy Factory" Context. *Teaching Children Mathematics.* 14(1) 25-31.

Using a candy factory context for a problem solving activity, students were better able to develop a deeper understanding of the mathematical concepts behind the algorithm of division. The problem-solving design allows students to develop their own strategies to understand the concept of division.

Weiss, D.F. (2006) Keeping It Real: The Rational for Using Manipulatives in the Middle Grades. *Mathematics Teaching in the Middle Schools.* 11(5)238-242.

Reviews of research show that manipulatives are effective as a learning tool. It is not the manipulative itself leading to understanding but the activity in which the students are engaged and using the tools to aid learning. Students should be comfortable using manipulatives so as to not add an additional layer of frustration to the activity.

Invitation to Learn

On separate laminated cards, have written division problems and a matching card with the answer. Spread the cards in the center of the room. Each person picks up a card and searches for the matching card. When a match is found, students perform 5 jumping jacks (or other physical activity as designated) while saying the problem and answer. Cards are placed in a stack and the activity continues until all cards are matched. This activity promotes getting students out of their chairs and active while learning.

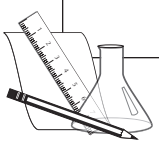
Materials

- ❑ Carryout food boxes
- ❑ Dice
- ❑ Miscellaneous items
- ❑ Small paper plates
- ❑ Large paper plates
- ❑ *Dinner is Served*
- ❑ Division tile sets
- ❑ Spinners with numbers1-9

Instructional Procedures

Mystery Dinner

1. Prior to class, fill boxes with miscellaneous items, making a matching set for each group. Mark each set with a course number of 1-6.
2. Divide the class into groups of 12 and further split them into 6 pairs.
3. Each pair will work together to complete the tasks on the *Dinner is Served* worksheet. Remind pairs that they will switch courses when they hear the dinner bell.



4. Distribute to each group boxes, 6 die, plates and worksheets.
5. Demonstrate to the class the process of setting up their serving platter, and fair sharing them onto the plates. Explain to groups how to record their information on the worksheet. Members of the group alternate the responsibility of the maitre d' to check the recording of the course and approve it.
6. Each course has a number and has a plate representing the number of items in the box. Next to the plate is a place to record the number of servings that were filled. The space above the plate indicates the number of objects on each plate and the number of leftovers.
7. Ring the bell and dinner is served!
8. Pairs will take their first course, dump it onto the serving plate, roll the die to determine the number of servings required. Inform students if they roll a 1, it automatically becomes a 7. Pairs will then set out that number of small plates and begin to share the "food" equally. Any leftovers will remain on the serving plate.
9. Student pairs will take their first course box and begin completing worksheet.
10. Within their group, pairs will exchange boxes until all courses have been completed.

Division Tiles

1. Instruct students to deal out the tiles, face up in 10 stacks. Since there are 54 tiles, piles will end up with some stacks of 5 and some stacks of 4.
2. Remove tiles in pairs. In each pair, disregard the remainder and make sure each quotient matches.
3. As each pair is removed, cross them out to easily identify the removed pairs. Continue to match quotients and remove pairs.
4. If a pile runs out, split any other pile at any point and place in the open space.
5. As in solitaire, if at any time no pairs are showing, the player has lost to the deck and will need to begin again.
6. If the last 2-8 tiles do not pair out, a mistake has been made in a previous pairing.
7. Examine each of the removed sets of tiles and check for an error. When the error is found those tiles are placed on the table and the game continues.

8. A student "wins" when all tiles have been placed into pairs.

No Remainder

1. Spin 4 times and record the number each time.
2. Have the students use the four numbers to try to make a division problem with no remainder.
3. See how many different problems can be made with the four numbers.
4. Have students share their findings in their journals. If you are sure a problem cannot be made with no remainder, explain your reasoning.

Assessment Suggestions

- A walk around during the dinner activity will give an informal assessment of understanding of fair sharing through division.
- Journal writing explaining real world problems similar to the dinner activity. Students should present their solutions in writing and explain their reasoning.
- Assign division problems and ask students to show 2-3 different ways to figure the answer and explain their reasoning.
- Provide numbers and students will determine which are divisible by 2, 3, 5, 6, 9, and 10.
- Alter the game *No Remainder* by spinning five times.

Curriculum Extensions/Adaptations/ Integration

- To make Division Tiles more challenging, use less than 10 piles.
- To increase the chances of winning, increase the number of piles for less skilled players.
- Division Tiles variation- the game can be played matching the remainders and ignoring the quotient.
- Easier tiles can be made with no remainders for students needing extra practice.
- Have students play the game War with the tiles.
- Play No Remainder with playing cards or dice to determine the numbers in the problem.

- Extend this lesson to vocabulary terms of quotient, divisor, dividend and remainder. Students are then ready to begin the development of long division skills.

Family Connections

- Have students fill a dinner course box with an item from home and share it with a group.
- Students can take home a set of division tiles and teach the game to a parent.
- Have students teach No Remainder to a parent and race to see who can find a problem with no remainder first.
- Remember to list any handouts, worksheets, etc. that are to be sent home with the student.

Additional Resources

Books

About Teaching Mathematics, A K-8 Resource, by Marilyn Burns; ISBN 978-0-941355-76-6

Dinner is Served

course 1

leftovers

# of servings

Maitre d'

course 2

leftovers

# of servings

Maitre d'

course 3

leftovers

# of servings

Maitre d'

course 4

leftovers

# of servings

Maitre d'

course 5

leftovers

# of servings

Maitre d'

course 6

leftovers

# of servings

Maitre d'

Division Tiles

Set 1	Tiles	Beginning
36 ÷ 6	18 ÷ 6	56 ÷ 7
42 ÷ 7	63 ÷ 7	21 ÷ 7
35 ÷ 7	64 ÷ 8	14 ÷ 7
30 ÷ 5	45 ÷ 5	42 ÷ 6
25 ÷ 5	12 ÷ 4	54 ÷ 6
12 ÷ 6	48 ÷ 6	24 ÷ 6
14 ÷ 2	16 ÷ 2	21 ÷ 3
18 ÷ 3	24 ÷ 3	36 ÷4

28 ÷ 7	32 ÷ 4	72 ÷ 9
56 ÷ 8	32 ÷ 8	72 ÷ 8
48 ÷ 8	16 ÷ 2	35 ÷ 7
24 ÷8	56 ÷ 8	63 ÷ 9
9 ÷ 9	36 ÷ 9	27 ÷ 3
36 ÷ 4	54 ÷ 9	72 ÷ 9
30 ÷ 5	24 ÷ 8	80 ÷ 10
16 ÷ 4	81 ÷ 9	54 ÷ 9
8 ÷ 8	27 ÷ 9	36 ÷ 9
63 ÷ 9	45 ÷ 9	28 ÷ 4

Set 2	Tiles	Advanced
52 ÷ 9	71 ÷ 7	38 ÷ 9
32 ÷ 9	35 ÷ 9	89 ÷ 9
83 ÷ 9	38 ÷ 10	43 ÷ 10
29 ÷ 8	54 ÷ 8	16 ÷ 7
55 ÷ 9	85 ÷ 9	21 ÷ 9
40 ÷ 9	14 ÷ 9	70 ÷ 9
47 ÷ 8	13 ÷8	42÷ 8
19 ÷ 8	52 ÷ 8	35 ÷ 8
36 ÷ 8	63 ÷ 8	76 ÷ 8

14 ÷ 2	17 ÷ 2	21 ÷ 3
19 ÷ 3	26 ÷ 3	10 ÷ 4
48 ÷ 7	18 ÷ 4	24 ÷ 4
33 ÷ 6	49 ÷ 6	27 ÷ 5
28 ÷ 5	19 ÷ 5	54 ÷ 9
13 ÷ 2	50 ÷ 6	27 ÷ 6
40 ÷ 6	22 ÷6	24 ÷ 9
43 ÷ 7	65 ÷ 7	31 ÷ 7
39 ÷ 7	34 ÷ 6	20 ÷ 7

Science II-2&3

Activities

Erosion/Uplift

Utah's Geological History

Standard II:

Students will understand that volcanoes, earthquakes, uplift, weathering, and erosion reshape Earth's surface.

Objective 2:

Explain how volcanoes, earthquakes, and uplift affect Earth's surface.

Objective 3:

Relate the building up and breaking down of Earth's surface over time to the various physical land features.

Intended Learning Outcomes:

1. Use science process and thinking skills
2. Manifest scientific attitudes and interests
4. Communicate effectively using science language and reasoning

Content Connections:

Social Studies 11-1; Use maps to analyze physical features

Science Standard II

Objectives 2 & 3

Connections

Background Information

Earth's surface is constantly changing. Some changes happen very slowly over long periods of time, such as weathering, erosion, and uplift. Other changes happen abruptly, such as landslides, volcanic eruptions, and earthquakes. All around us, we see the visible effects of the building up and breaking down of Earth's surface.

Most students grasp an understanding of weathering and erosion, but they do not understand geological forces and process that have occurred on Earth over long periods of time. Common misconceptions are that Lake Bonneville was the only lake that existed in Utah; volcanoes are the only things causing Earth's surface to uplift; and Earth is not changing. While it is true that Earth will not change very much in their lifetime, Earth is changing all the time. These activities are designed to help students understand that erosion and uplift are forces that are active right now and they have and will continue to change Earth's geological face.

This activity is designed to familiarize the students with the vocabulary, investigate the geological changes that Utah has gone through over time, and develop an understanding that uplift creates the mountains and valley areas on Earth's surface and that fault lines are often in earthquake zones.

Research Basis

Sutton, J., & Krueger, A. (Eds.). (2002). *EDThoughts: What we know about science teaching and learning*. How does teacher pedagolgical knowledge impact instruction? Aurora,

How does teacher pedagolgical knowledge impact instruction CO: Mid-continent Research for Education and Learning. 28-29

This article stresses that different teaching methods accomplish different goals. High-quality science teaching should include a deep knowledge of subject matter, incorporates inquiry, and focuses on skills of observation, information getting, predicting, and testing. It should be carefully aligned to curriculum, assessment, and high standards. Building on real-life situations that apply concepts (hands-on) deepens understanding. Varied opportunities for discussion and reflection are incorporated in science teaching.

TAN, Kok Siang (June, 2007) Using "What if" questions to teach science. *Asia-Pacific Forum on Science Learning and Teaching*, Volume 8, Issue 1, Article 16. Accessed January 5, 2008 http://www.ied.edu.hk/apfslt/v8_issue1/tanks/tanks5.htm

Using "what if" questions are a reflective learning strategy that can be effective in classroom situations. Students are actively engaged in thinking up possibilities, talking about ideas and developing deeper insights. Through "what if" questions social interaction occurs and real life problem solving skills are employed.

Invitation to Learn

Invite students to hypothesize: What geological change has Utah has gone through over time? Ask what they might know about Utah's geological past. Ask if anyone has heard that the Great Salt Lake area was once filled with water (Lake Bonneville). At this time if students are unable to use correct terminology, review vocabulary. Two ways are provided: *Vocabulary Match* and *Vocabulary Whip*. Directions for Vocabulary Whip - Ask one person to start; he/she reads their card exactly as written. The next person to read has the card that has the vocabulary word for the definition read. Students continue to read their cards until it returns to the first person that read. (It does not matter which definition is read to start the game.)

Materials

- ❑ *Blank Utah Map*
- ❑ *Vocabulary Match Answers*
- ❑ *Vocabulary Match*
- ❑ *Vocabulary Whip*
- ❑ Poster – Utah: A Geologic History
- ❑ *Utah Cutout Descriptions*
- ❑ *Fault Blocks*
- ❑ *ABC Fault Blocks*
- ❑ *Wasatch Fault Figure*
- ❑ Utah Relief Map
- ❑ 3D Stereo Topographic Map of Utah
- ❑ 3D Glasses

Instructional Procedure

1. Ask the Big idea question: "What geological processes has the Utah area gone through over time?" What made the mountains? What made the valleys? How long did it take?

   Group Activity: Use the cutouts from the Utah: A Geologic History poster. In this activity students will look at cutout pictures of Utah's geological past. Pass out the cutouts. Ask each group to hypothesize what is going on in their cutout pictures. Then using the Utah: A Geologic History poster, have each group try to determine where the cutout fits into the poster. It should be

very difficult for them to determine where to place their cutout. Have all the students be seated and invite several students to read the Utah Cutouts information card set. Start at #1. As the card is being read, the group that has that cutout will come and put it on the poster. Discuss what geological forces are apparent in the cutout and what happened at that stage of Utah's development. Focus on what processes would have been working on the Utah area at that particular time. (Volcanoes, uplift, erosion) Encourage open discussion about the geological processes that would have caused the changes the picture represents and how Earth's surface has been built up (uplift) and eroded away (erosion). Close this part of the activity by asking, "How do scientists know this information?" "What evidences do they use to determine what Utah used to look like?"

2. Show the Utah Relief Map. Invite students to come up and point out geological features they can see.
3. Develop understanding by using the cardstock *Fault Blocks*. Use the blocks to show how mountains and valleys are formed. Point out that mountain uplift is occurring on one or both sides of the fault blocks and a valley is being made in the middle. Discuss, "**What if only one side of the fault is uplifted?**" Handout *ABC Fault Block* page to students. Have them cut out the blocks and use them as you demonstrate what the questions are asking on the handout. Develop the idea that A and C moving away from each other create mountains (A, C) and the B area would become a valley. Then move A and C together. Help students understand that uplift would occur (B area). Show *Wasatch Front* figure. Ask questions to correlate how the figure and the fault blocks are similar. (Students should discover that where the mountains and valley meet there is a fault line.)
4. Hypothesize – **What if there were no uplift forces or erosion, what would happen to Earth?** Have a few students respond to this. Direct the discussion until students understand that Earth would be flat and unchanging without these acting upon it.
5. Use the 3D Stereo Topographic Map of Utah and 3D glasses. Allow students to view the map with the glasses so they can see how topographic map lines show physical features of Earth. Invite several students to find areas where uplift has occurred. Find areas were drainage and erosion has had an effect. Have students locate rivers and have them trace or hypothesize how water flows down mountains into rivers and finally into drainage areas.

6. Introduce the idea that Utah has a fault line. This is an area where forces from plate tectonics have compressed Earth. Use a long sleeve of someone in the group. Push up the sleeve and see how the material wrinkles, and then as the force is released it spreads out more, but still has lines in it. Use the Utah Relief Map to analyze areas where Earth has been compressed, uplifted, eroded, etc. Direct students to look at the area west of the Great Salt Lake and into Nevada. Have them find the lines that show where uplift has occurred because of compression and how it has spread out as the compression has released.
7. The final step in the lesson is to locate fault lines in Utah. Use *Blank Utah Map* and have students draw a faint line where they think the fault line might be located. Draw the shape of Utah on a whiteboard or chalkboard. (Teacher refer to Wasatch Fault booklet for information on fault line.) Have an open discussion to develop the idea that this is why Utah is in an earthquake zone and has frequent earthquakes. Discuss that there are many faults all over Earth's surface and help students understand that fault zones are one reason for frequent earthquakes throughout the world.

Assessment Suggestions

- Participation in vocabulary activities and Utah Geological timeline.
- Use *ABC Fault Blocks* to show how a valley and mountains are made. Journal activity, draw ABC Fault Blocks in book and label with arrows uplift, valley, mountain.
- Correctly identify the Utah fault line on the blank map.
- Journaling activity – either written or pictorially, list several answers to the big idea question of

  "What geological processes has the Utah area gone through over time?"
  (Some things that should be in the journal would be fault blocks, uplift, mountains, valleys, other changes, fault lines and earthquakes.)

Curriculum Extensions/Adaptations/ Integration

- *Utah Geological Survey Activity 21* – which is a lesson about locating geological features on United States Shaded Relief Map
- Invite students to learn about the hazards of earthquakes in Utah, e.g., liquefaction.

- Invite students to learn about seismographs and how they are used with earthquakes.
- Allow students to draw pictures of vocabulary words in a journal so they can make associations with vocabulary words.
- Make a Social Studies connection by having students predict what physical features of Utah helped it become a part of the United States. (e.g. migration trails, Great Salt Lake, desert, mineral deposits – mines in Utah).
- Use a World Map and draw the major plates of plate tectonics.
- Research natural resources that are unique to Utah and how those resources are used in everyday life.
- In a newspaper or travel magazine find articles about Utah's geology.
- To reinforce vocabulary, use *Capitol Reef* web page handout. Students (group or individual) highlight any vocabulary words that can be found in the document. Have several volunteers share the vocabulary words they found in the document.

Family Connections

- For extending learning at home invite families to identify geologic features in their own area.
- Collect rocks near students' homes and determine what geological forces have created that rock.
- Identify earthquake hazards in their own town.
- Learn what to do during an earthquake at home and other places.
- Invite families to find rocks or other formations that show changes that Utah has gone through.
- Look through a Utah Travel guide and find places in Utah that have unique geology.
- Plan a visit to a geological museum in their area.
- Find what geological features Utah is famous for and try to locate and collect postcards of that area.
- Provide a set of *Vocabulary Match* for practice at home.

Additional Resources

Booklet

The Wasatch Fault, Utah Geological Survey Public Information Series 40, 1996; ISBN 1-55791-387-0 available PDF http://ugs.utah.gov/online/pdf/pi-40.pdf

Earthquake hazards and safety in Utah (pdf), Public Information Series #6 http://ugs.utah.gov/online/pdf/pi-6.pdf

Photo essay of four Utah earthquakes, 1921-1972 (pdf) Public Information Series #72 http://ugs.utah.gov/online/pdf/pi-72.pdf

Media

Vocabulary PowerPoint, by Gennie Kirch developed using Microsoft Office, 2008

Utah: A Geologic History, Utah Geological Survey; Public Information Series #54

Wasatch Front poster and Fault Blocks, Utah Geological Survey, UGS office at the Department of Natural Resources (DNR) Building at 1594 West North Temple, Suite 3110, Salt Lake City. 801.537.3300; http://www.ugs.state.ut.us/

Web sites

How was Utah's Topography Formed? http://geology.utah.gov/surveynotes/gladasked/gladtopoform.htm

Recent Utah Earthquakes, University of Utah Seismograph Stations http://www.quake.utah.edu/recactivity/recent.shtml

Capitol Reef - http://www.nps.gov/archive/care/geology1.htm

USGS National Map Viewer http://nmviewogc.cr.usgs.gov/viewer.htm

USGS Earthquakes http://earthquake.usgs.gov/

U of U Seismograph Stations Research: Basic Information about Active Faults of Utah

http://www.seis.utah.edu/edservices/EES/ActiveFaultInfo.shtml

Utah Museum of Natural History http://www.umnh.utah.edu/

Organizations

Utah Geological Survey, UGS office at the Department of Natural Resources (DNR) Building at 1594 West North Temple, Suite 3110, Salt Lake City. 801.537.3300; http://www.ugs.state.ut.us/

Local Earth-Science Resources for Utah Teachers http://geology.utah.gov/teacher/teacher_resources.htm

Teaching Kits

Rock, mineral, and fossil; grade 4 (can also be used for grades 2 [rocks], and 8 and 9 [extinction]).
Landforms; grade 5
Dinosaurs; grades K-6.
Ice Age; grades 4, 8, and 9 (includes extinction and climate change).

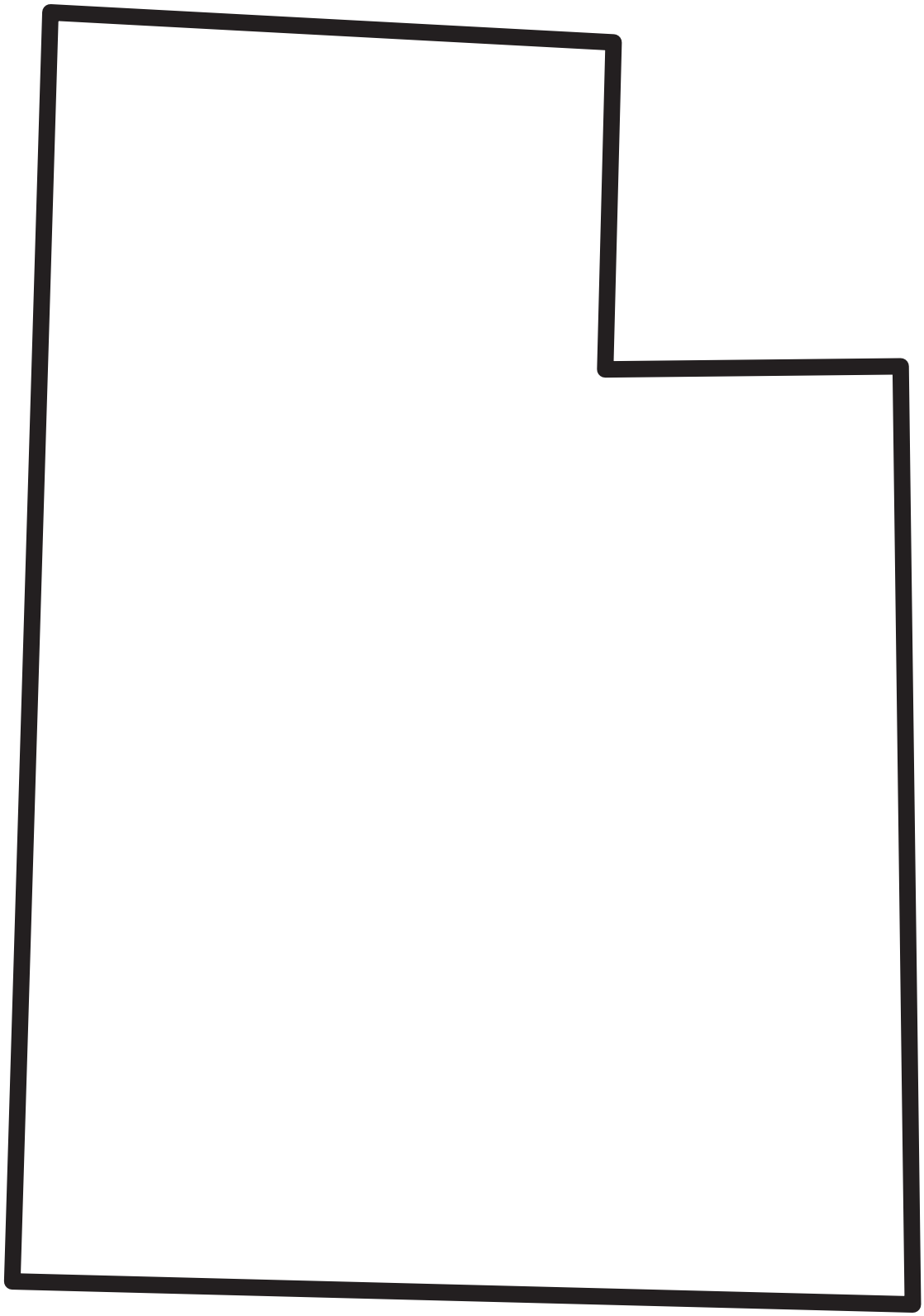
All kits are available at the UGS for a refundable deposit. Call 801-537-3300 or http://geology.utah.gov/teacher/teachkits.htm for more information about these kits.

Classroom Materials

Hands-on Activities
5th-grade landforms and geologic processes (volcanoes, earthquakes, uplift, weathering, erosion, deposition): contact Sandy Eldredge (UGS) at 801-537-3325.

Slide Sets
5th-grade landforms and geologic processes: contact Sandy Eldredge (UGS) at 801-537-3325.

Utah Map



Vocabulary Match (Answers)

Arch Arching landform created by weathering and erosion.	**Erosion** To carry away, to wear away. Removal of rocks and dirt by wind, water and ice.	**Weathering** The process of breaking down rock and other materials into smaller pieces. Weathering breaks it down. Erosion carries it away.
Uplift Upward movement of Earth's crust.	**Earthquake** Shaking or trembling of the earth caused by movement along a fault.	**Volcano** Vents in Earth's crust that lava and steam can travel through.
Glacier Slow-moving masses of snow and ice that carry rock and dirt.	**Flash Flood** A flood caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. A flash flood rises rapidly, often with little or no warning.	**Avalanche** A fall or slide of a large mass, as of snow or rock, down a mountainside.

Erode To wear away	**Landslide** A slide of a large mass of dirt and rock down a mountain or cliff.	**Butte** A steep, flat-topped hill created by erosion.
Fault A break or fracture in the crust of Earth.	**Geological** Having to do with geology, the study of Earth.	**Wind Erosion** The wearing away of soil and other sediments by winds that remove soil from one point on the Earth's surface and deposit it elsewhere.
Water Erosion The carrying away of soil and sediments by water that remove sediments from one point to another.	**Deposition** The process of layering sediments.	**Chemical Weathering** Chemical reactions break down the bonds holding the rocks together, causing them to fall apart, and forming smaller and smaller pieces.

Vocabulary Match

Arching landform created by weathering and erosion.	To carry away, to wear away. Removal of rocks and dirt by wind, water and ice.	The process of breaking down rock and other materials into smaller pieces. Weathering breaks it down. Erosion carries it away.
Upward movement of Earth's crust.	Shaking or trembling of the earth caused by movement along a fault.	Vents in Earth's crust that lava and steam can travel through.
Slow-moving masses of snow and ice that carry rock and dirt.	A flood caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. A flash flood rises rapidly, often with little or no warning.	A fall or slide of a large mass, as of snow or rock, down a mountainside.

To wear away.	A slide of a large mass of dirt and rock down a mountain or cliff.	A steep, flat-topped hill created by erosion.
A break or fracture in the crust of Earth.	Having to do with geology, the study of Earth.	The wearing away of soil and other sediments by winds that remove soil from one point on the Earth's surface and deposit it elsewhere.
The carrying away of soil and sediments by water that remove sediments from one point to another.	The process of layering sediments.	Chemical reactions break down the bonds holding the rocks together, causing them to fall apart, and form smaller and smaller pieces.

Weathering	Volcano	Avalanche
Erosion	Earthquake	Flash Flood
Arch	Uplift	Glacier

Butte	Wind Erosion	Chemical Weathering
Landslide	Geological	Deposition
Erode	Fault	Water Erosion

Vocabulary Whip

I have Chemical Weathering. I am looking for the word that means Arching landform created by weathering and erosion.	**I have Arch.** I am looking for the word that means To carry away, to wear away. Removal of rocks and dirt by wind, water and ice.	**I have Erosion.** I am looking for the word that means The process of breaking down rock and other materials into smaller pieces. Weathering breaks it down. Erosion carries it away.
I have Weathering I am looking for the word that means Upward movement of Earth's crust.	**I have Uplift.** I am looking for the word that means Shaking or trembling of the earth caused by movement along a fault.	**I have Earthquake.** I am looking for the word that means Vents in Earth's crust that lava and steam can travel through.
I have Volcano. I am looking for the word that means Slow-moving masses of snow and ice that carry rock and dirt.	**I have Glacier.** I am looking for the word that means A flood caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. A flash flood rises rapidly, often with little or no warning.	**I have Flash Flood.** I am looking for the word that means A fall or slide of a large mass, as of snow or rock, down a mountainside.

I have Avalanche. I am looking for the word that means To wear away.	**I have Erode.** I am looking for the word that means A slide of a large mass of dirt and rock down a mountain or cliff.	**I have Landslide.** I am looking for the word that means A steep, flat-topped hill created by erosion.
I have Butte. I am looking for the word that means A break or fracture in the crust of Earth.	**I have Fault.** I am looking for the word that means Having to do with geology, the study of Earth.	**I have Geological.** I am looking for the word that means The wearing away of soil and other sediments by winds that remove soil from one point on the Earth's surface and deposit it elsewhere.
I have Wind Erosion. I am looking for the word that means The carrying away of soil and sediments by water that remove sediments from one point to another.	**I have Water Erosion.** I am looking for the word that means The process of layering sediments.	**I have Deposition.** I am looking for the word that means Chemical reactions break down the bonds holding the rocks together, causing them to fall apart, and forming smaller and smaller pieces.

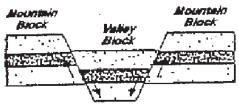
Utah Cutout Descriptions

#1 The Early Years: Paleozoic During this era Utah was at the western edge of North America. The eastern portion of the state was a low plain with little relief at about sea level. What little sediment did reach the ocean was well washed quartz sand. Coral reefs, now exposed as thick limestones in the Wasatch Mountains, marked shallow seas that led to deep oceans in the west.	#2 Wind Deposited Sands: Early Jurassic Cut off from moisture-laden ocean winds by rising mountains to the west, desert sands were blown into Utah from the north and southwest. These blowing sands formed dunes which eventually turned into rock and are preserved in what is now called Navajo Sandstone. These ancient dunes are well exposed at Checkerboard Mesa in Zion National Park and on the San Rafael Swell.	#3 Famous Dinosaurs: Late Jurassic At this time Utah was hot, swampy lowland with mountains and volcanoes to the west and northwest. Meandering rivers and lakes abounded, while dinosaurs roamed the land. Their fossilized bones are preserved and can be seen at famous sites such as the Cleveland-Lloyd Dinosaur Quarry and Dinosaur National Monument.	#4 Coal Formations: Late Cretaceous Pressure from continental collision with the Pacific Plate to the west produced high mountains in western Utah. The eastern portion of the state was covered by an inland sea that stretched from the Gulf of Mexico to the Arctic. The coastal plain between these two areas advanced and retreated as sediment filled the sea and the basin filled the sea and the basin sank. Coal swamps formed behind barrier islands while dinosaurs continued to rule.	#5 Utah Starts to Come Up in the World: Paleocene Erosion worn down the mountains to the west and the sediments filled the inland sea to the east. Continued pressure from the Pacific Plate caused both the Uinta Mountains and the Colorado Plateau to uplift. The Colorado Plateau warped as it rose, marking the beginning of predominate swells and depressions now found in Utah (such as San Rafael Swell). A large freshwater body, called Lake Flagstaff, occupied a depression in what is now central Utah.
#6 Oil Shale and Fossil Fish: Eocene After spending nearly 500 million years near sea level, Utah continued its rise to nearly a mile high in elevation. Continued warping of the Colorado Plateau produced basins for lakes such as Lake Uinta. Organic-rich accumulations in the bottom sediments include well-preserved fish fossils and oil shales. The western mountains were reduced to relics.	#7 Uplift and Volcanics: Oligocene On the Colorado Plateau the lake basins were filled in and broad plains separated mountain uplifts. The beginning of modern rivers ran across these plains. The continental divide passed through northeastern Utah so the Green River in Wyoming drained to the Mississippi River. With the beginning of extension in western Utah, which would eventually lead to the Basin and Range, extensive volcanic activity started to occur.	#8 Precious Metals Emplaced: Micocene Whereas previous compression has moved the site of San Francisco close to Salt Lake City, extension was now moving the two apart. This extension separated uplifted mountain blocks from down-dropped basins forming the Basin and Range. Volcanic activity continued forming three great metallic mineral belts. From north to south they are: Park-City-Oquirrh, Deek Creek-Tintic, and Wah Wah-Tushar. The Colorado Plateau continued to rise and tilt northeastward.	#9 Water and Ice: Pleistocene The geography of Utah was very close to what it is now. Mountains, canyons, and rivers were all well in place. The climate at this time was wetter and colder and as a result glacial activity took place. Canyons were carved and expanded in the Uinta Mountains as well as in several other mountain ranges throughout the state. A giant water body called Lake Bonneville also formed, stretching from the Wasatch Mountains to Nevada and from the Utah-Idaho border nearly down to Cedar City in southern Utah.	#10 These are the Places: Present The geologic history of Utah has left an indelible mark on the state. It explains why the rocks to the east are brightly colorful while those to the west have somber colors, why there are spectacularly massive canyons on the Colorado Plateau while much of the Basin and Range has no external drainage, and why a high mountain chain, the Wasatch, runs down the middle of the state. This history determines the location of settlements, industry, and recreation sites.

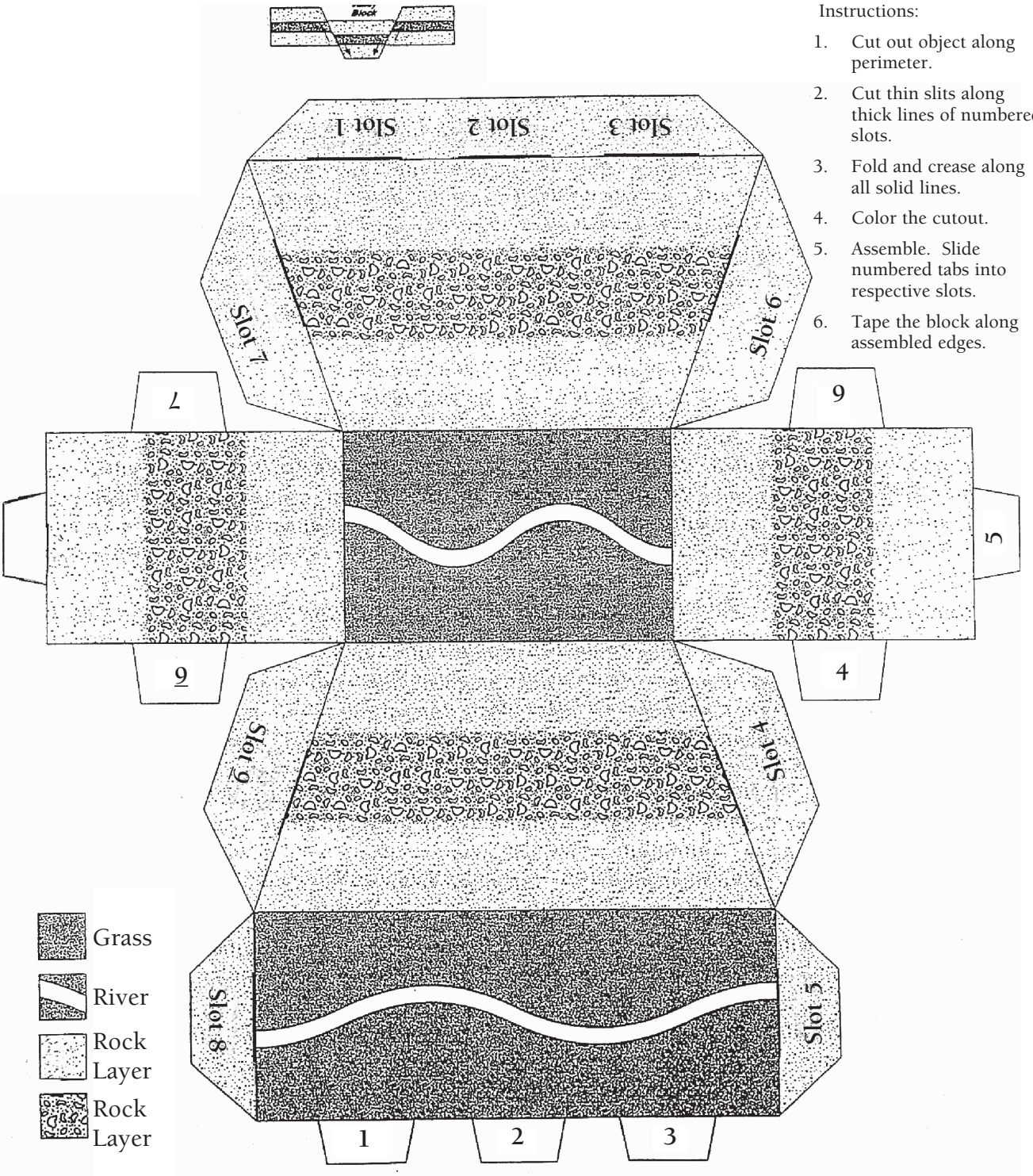
Mountain Fault Block

Instructions:

1. Cut out object along perimeter.
2. Cut thin slits along thick lines of numbered slots.
3. Fold and crease along all solid lines.
4. Color the cutout.
5. Assemble. Slide numbered tabs into respective slots.
6. Tape the block along assembled edges.



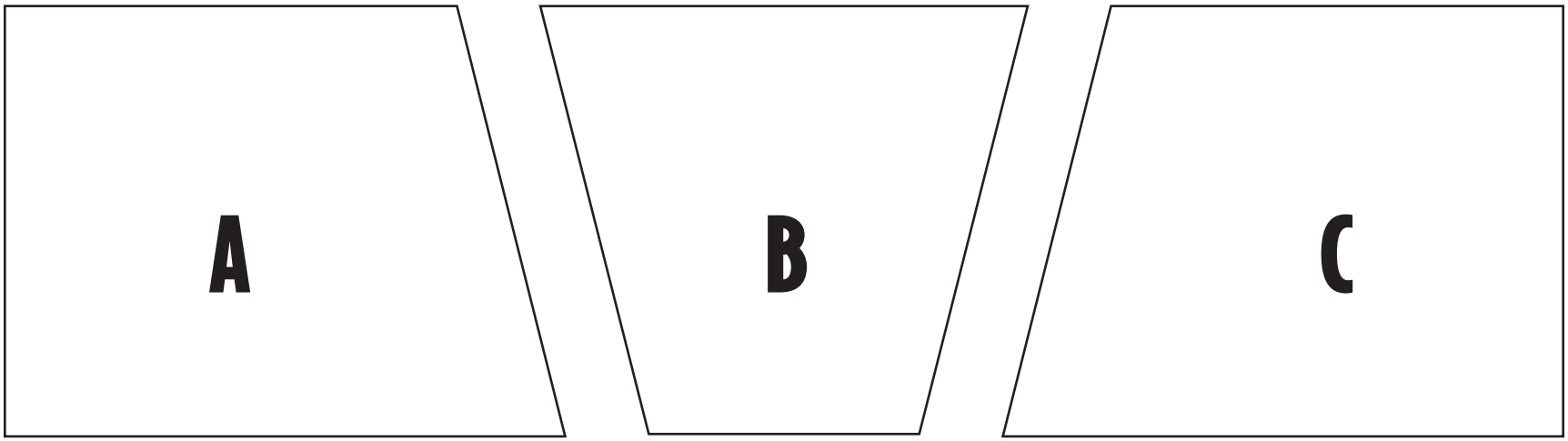
Mountain Fault Block continued



Instructions:

1. Cut out object along perimeter.
2. Cut thin slits along thick lines of numbered slots.
3. Fold and crease along all solid lines.
4. Color the cutout.
5. Assemble. Slide numbered tabs into respective slots.
6. Tape the block along assembled edges.

ABC Fault Blocks



Move A and C away from each other, what happens to B?
What does B make?

Move A and C towards each other, what happens to B?

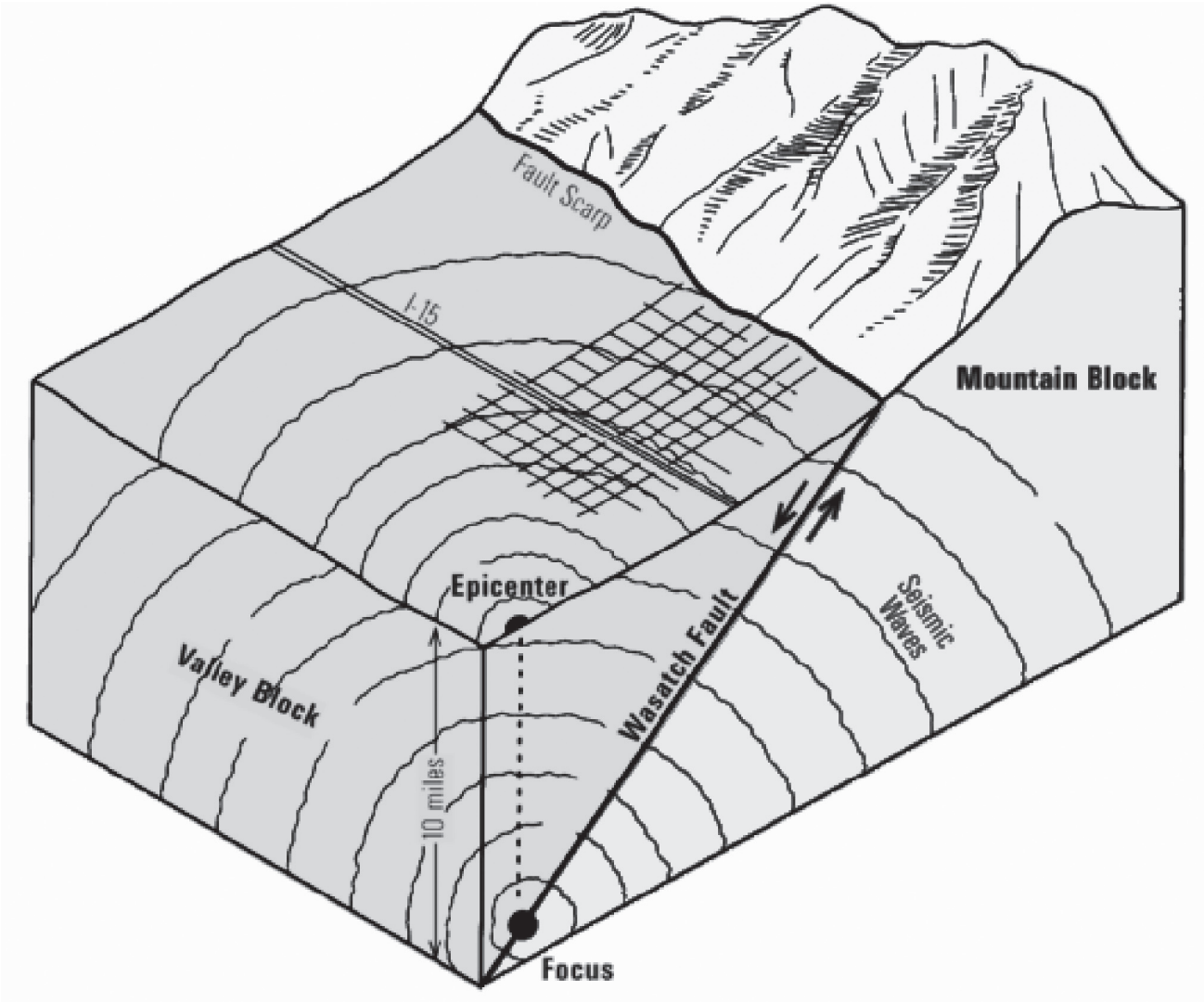
What does B make now?

Can you should how uplift could occur using these pieces?

What would happen if only A moved up and B stayed where it was.

*Can you find any areas in Utah that are similar to these pieces?

Wasatch Fault Figure



Researching Relief Maps

Standard II:

Students will understand that volcanoes, earthquakes, uplift, weathering, and erosion reshape Earth's surface.

Objective 2:

Explain how volcanoes, earthquakes, and uplift affect Earth's surface.

Objective 3:

Relate the building up and breaking down of Earth's surface over time to the various physical land features.

Intended Learning Outcomes:

1. Use science process and thinking skills
2. Manifest scientific attitudes and interests
3. Communicate effectively using science language and reasoning

Content Connections:

Math I-1; Integers/number line.
Math III-2; Locations/coordinate plane.

Science Standard II

Objectives 2 & 3

Connections

Background Information

Earth's surface is constantly changing. Some changes happen very slowly over long periods of time, such as weathering, erosion, and uplift. Other changes happen abruptly, such as landslides, volcanic eruptions, and earthquakes. All around us, we see the visible effects of the building up and breaking down of Earth's surface.

Although most students grasp an understanding of weathering and erosion, they do not understand geological forces and process that have occurred on Earth over long periods of time. Most students understand weathering, erosion and uplift as separate concepts. A common misconception of students is how much time it takes for geologic changes. While it is true that Earth will not change very much in their lifetime, Earth is changing all the time. Another misconception is that weathering and erosion have changed Earth's surface the most. Even though weathering does impact Earth's features, erosion and uplift combined help create the contour to the surface, like the Grand Canyon. This activity is to help students understand that erosion and uplift are forces that are active right now and they have and will continue to change Earth's geological features.

The activities are designed to have students investigate what geological forces created some of Earth's topography and then predict what forces will probably act upon it in the future. Students will investigate areas of the world, United States and Utah to determine

what geological features are located on Earth and make predictions about what they think will happen in the future to that area. The materials are developed to differentiate for student ability levels. Students will need to have an understanding of integers, ordered pairs and coordinate grids to complete the activities. The world activity is for students that are reading on grade level or beyond. Use of the Dynamic Planet Map will help students understand how plate tectonics play into the grand scheme of earth's geological processes. The United States activity is for students on grade level or one level lower. The Utah activities are targeted to be for emergent readers. The materials are developed to be flexible and stress the concepts of uplift and erosion at each level. Activities can be completed as group, small group or individually.

Research Basis

Sutton, J., & Krueger, A. (Eds.). (2002). *EDThoughts: What we know about science teaching and learning*. Aurora, CO: Mid-continent Research for Education and Learning. 52-53

Research and best practice finds that reading, writing, and science are inseparable. Process skills of predicting, inferring, communicating, comparing and contrasting, and recognizing cause and effect relations are needed for science inquiry. Hands-on experiences improve comprehension of text. To increase writing competence, students must be able to organize and communicate observations and data, argue logically, and structure coherent conclusions.

Sutton, J., & Krueger, A. (Eds.). (2002). *EDThoughts: What we know about science teaching and learning*. Aurora, CO: Mid-continent Research for Education and Learning. 84-85

Learning for understanding should be emphasized, rather than memorized. The article states that different types of learning opportunities are necessary including experiential, symbolic learning, and use of pictorial or graphic representations (maps, films, videos, CD-ROMs, drawings) to help develop a greater depth of understanding.

Invitation to Learn

Pose the question: What geological processes have created areas of Earth? Invite students to brainstorm ideas about how Earth's features have been created. Show the United States Map. Facilitate an open discussion about what some of the lines on the map represent. Point out the latitude and longitude lines on a map. Explain that this is similar to a coordinate grid. Invite students to try and find a mountain location and state the latitude and longitude for that mountain range. Students should be encouraged to use correct vocabulary: (e.g., uplift, plate tectonics, mountains, etc.).

Instructional Procedures

1. For each level there is a blackline, letter sized master of *Utah map, United States Map or World Map.* Students are to use an acetate sheet of the *L-grid or P-grid* to overlay over the 8 ½ X 11 map.
2. Using the *Geological Processes List* students will identify areas on the letter-sized maps according to the coordinate given for the area.
3. Correlating the small map location dot to the large *Utah, United States* or *World Map*, students will analyze the large maps and see what geologic features are located in their research area. (Use Dynamic Planet Map, Google Earth, or Internet resource.)
4. Students will then find the Project Card or use the *Research List* to locate information on that area. They will read and discuss their findings and relate what forces they think acted upon the area.
5. Students fill out a *Research Cards* for each area they review. (There are two cards on each page; each student will need at least 2 pages.)
6. After everyone has filled out at least 4 cards, invite them to get into manageable small groups.
7. Choose a group leader. Then have each team member discuss an area they researched and what their findings were. Groups will need at least 10-20 minutes for this part of the activity.
8. As a class, discuss what was learned from the activity, review the concepts of some areas being uplifted, others are eroded (water, wind, chemical, mechanical) and deposited. If time, locate on rivers and where they drain. Discuss what natural disasters (hurricane, earthquake, floods, and avalanches) might impact specific areas on the maps.
9. Note: All three activities investigate the Grand Canyon and Colorado Plateau. Help students to understand that the main geologic processes involved in the Grand Canyon are erosion and uplift. Students many times think that weathering and erosion created the contours of the canyon. The Colorado River, erosion and uplift all were needed in order for the Grand Canyon to develop to what it is today.
10. As a group, hypothesize – What would happen if no erosion or uplift were acting upon Earth? What would it look like? How

Materials

- ❑ *Geological Processes List*
- ❑ Utah relief map
- ❑ World map
- ❑ National Atlas relief map
- ❑ *Research Card*
- ❑ *Landscape Grid*
- ❑ *Portrait Grid*
- ❑ *Research List*
- ❑ *Utah Map*
- ❑ *United States Map*
- ❑ *World Map*

would it be different? What will happen in the next 500 years, 5000 years, and one million years?

11. Journal activity. Students will paste their Research Cards into their journals. Invite them to summarize what they have learned today about erosion and uplift in one or two paragraphs.
12. Encourage students to put away maps and materials carefully as directed.

Assessment Suggestions

- Pre-assess student understanding of vocabulary for this Science Standard.
- Verify that students are using correct terminology while doing research.
- Use of coordinate grids to locate places on a large map.
- Use of study skills to locate information from *Research List* or Project Cards.
- Students will use the scientific process to analyze and hypothesize as they complete activity.
- Completion of at least 4 *Research Cards*.
- Appropriate behavior of listening and sharing in groups.
- Journal completed with *Research Cards* and written summary.

Curriculum Extensions/Adaptations/ Integration

- Challenge idea: How did geological processes impact people in the past?
- If available, have students view other topographical or physical maps. Compare and contrast how the maps show physical features. (Social Studies book, reference books)
- Do a research project on active volcanoes, famous volcanoes or earthquakes.
- Use a map of the world and draw lines to indicate where the tectonic plates are located.
- Locate additional areas on a map and explain the geological forces that have impacted that area.

- If students do not fully understand how to do coordinate grids, highlighters of different colors could be used to identify quadrant areas on the grid. List adaptations for learners with special needs.
- Practice locating latitude and longitude of areas instead of coordinate grids.
- Social Studies link - Investigate how geological features of Earth have created political boundaries or impacted civilizations.
- Locate 1-5 places in Utah that have unique geological impact. Bring in postcards or web pages with information for each place.

Family Connections

- Provide students with additional project cards. Have them discuss with their family geological areas that their family might be familiar with or would like to study. They can complete a *Research Card* for that area and add it to their journal.
- Locate an area nearby that has interesting geological features. Plan a family vacation to that area. Record what interesting sites might be found at that location. Math connection: calculate how far it is to the site and how many gallons of gas would be needed to complete the trip.
- When earthquakes or volcanoes happen on Earth, find newspaper or Internet articles that talk about the geological forces involved with the earthquake or volcano. Locate those places on a map. (Or as a class track geological events on a map throughout the year.)
- Write responses to this prompt: "If you could go anywhere in the world, where would that be and what would you want to see there?"

Additional Resources

Media

Utah Map - Relief map of Utah, 1:1,000,000, 1965, Map 20 Utah Geological Survey

United States Map - U.S. Geological Survey, Reston, Virginia 22092 Sheet Number 56 National Atlas Relief Map

The Dynamic Planet - Geological Investigations Series Map I-2800

Web sites

Wikipedia www.wikipedia.com

USGS National Map Viewer http://nmviewogc.cr.usgs.gov/viewer.htm

USGS This Dynamic Planet http://mineralsciences.si.edu/tdpmap/

This Dynamic Planet http://baird.si.edu/minsci/tdpmap/viewer.htm

USGS Earthquakes http://earthquake.usgs.gov/

Google Earth www.earth.google.com/

Geologic Points of Interest http://www.fs.fed.us/r4/resources/geology/geo_points_interest/activities/cliffs_canyons_outcrops.shtml

A Lesson in Plate Tectonics http://www.extremescience.com/PlateTectonicsmap.htm

Organizations

Utah Geological Survey, UGS office at the Department of Natural Resources (DNR) Building at 1594 West North Temple, Suite 3110, Salt Lake City. 801.537.3300; http://www.ugs.state.ut.us/

Research Card

Name: _____

Location: _____

What geological feature is located here?

What geological processes have occurred here?

What do you think will happen in the next 100 years?

What do you think will happen in the next 10,000 years?

Research Card

Name: _____

Location: _____

What geological feature is located here?

What geological processes have occurred here?

What do you think will happen in the next 100 years?

What do you think will happen in the next 10,000 years?

Research Card

Name: _____

Location: _____

What geological feature is located here?

What geological processes have occurred here?

What do you think will happen in the next 100 years?

What do you think will happen in the next 10,000 years?

Research Card

Name: _____

Location: _____

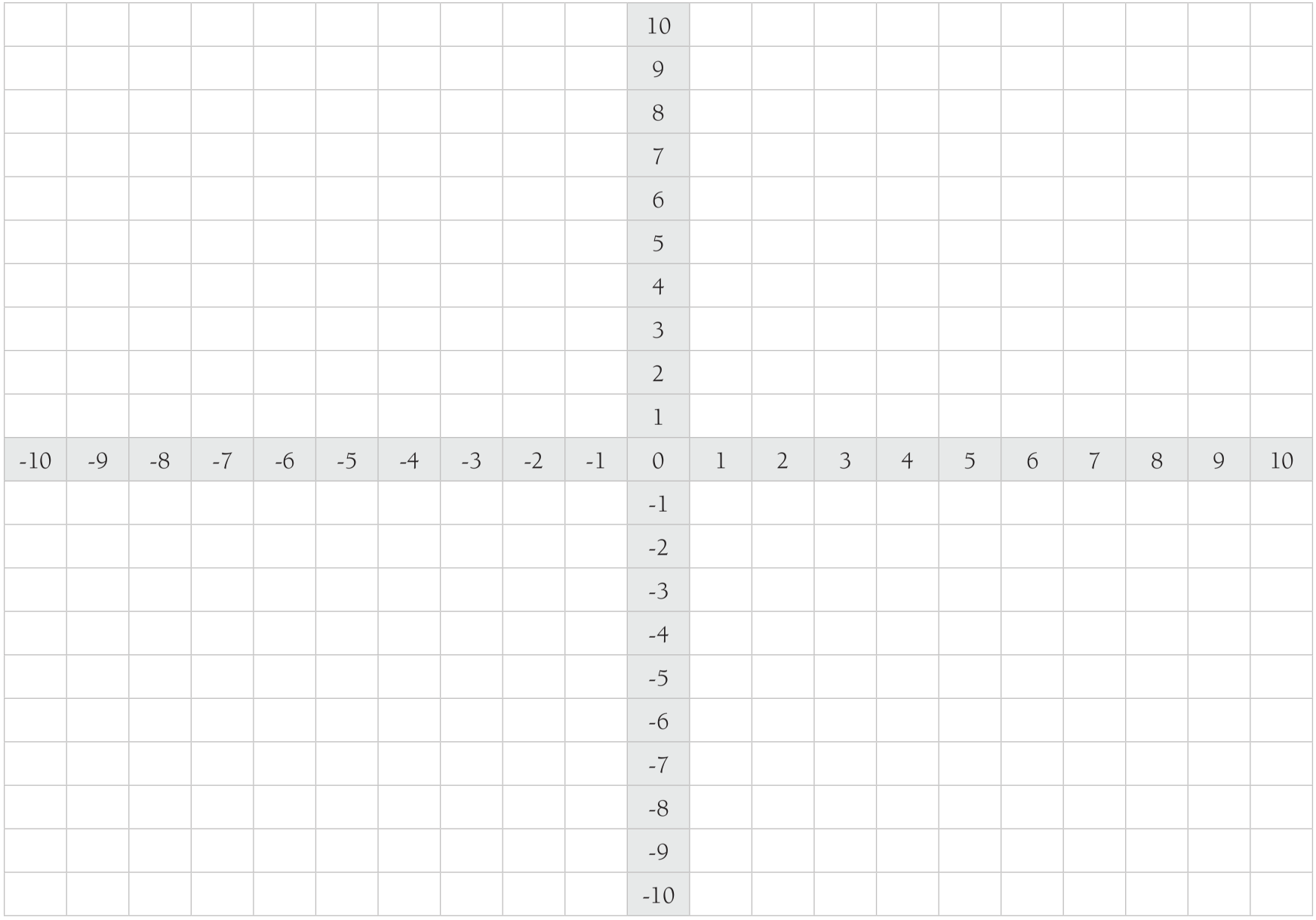
What geological feature is located here?

What geological processes have occurred here?

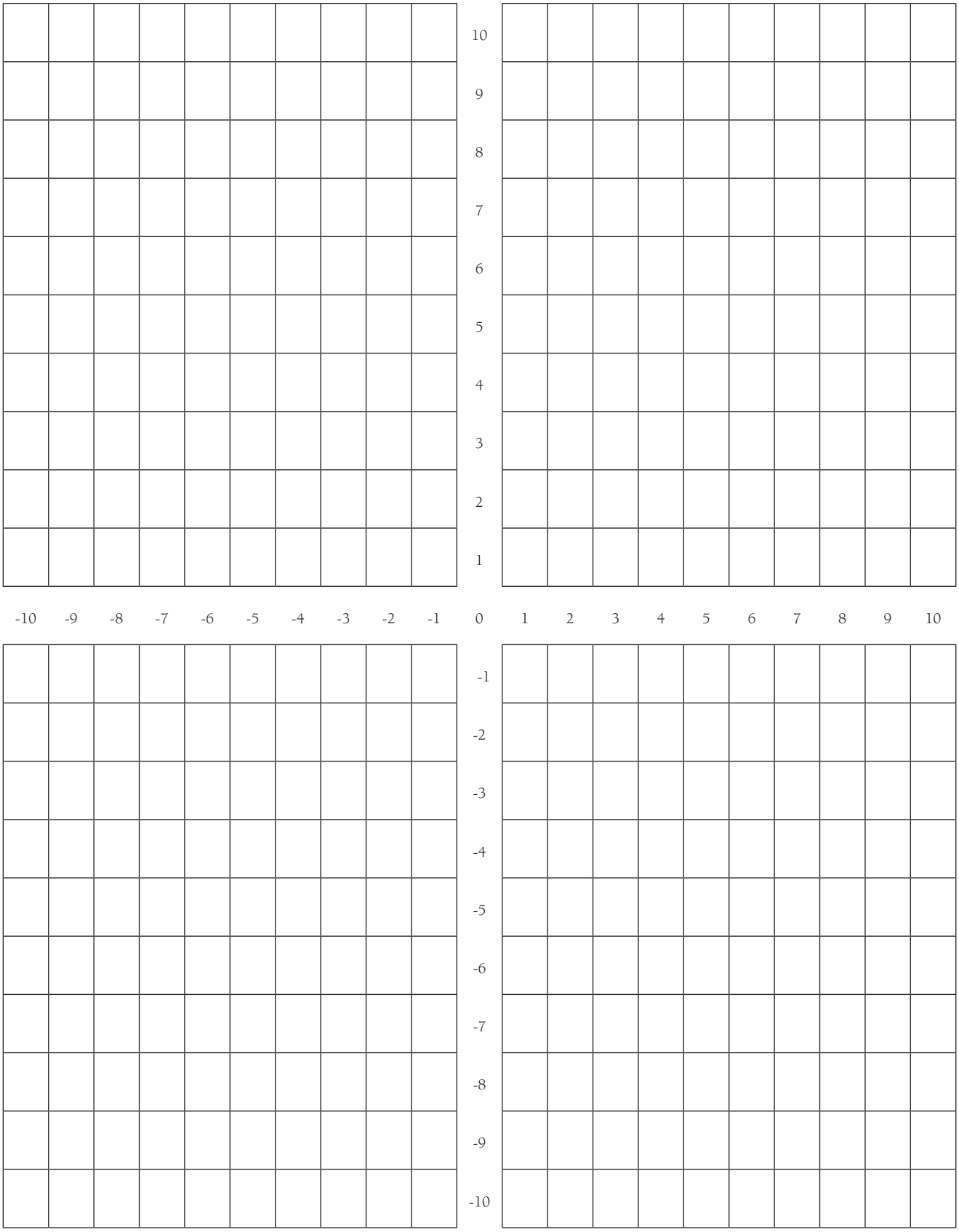
What do you think will happen in the next 100 years?

What do you think will happen in the next 10,000 years?

Landscape Grid



Portrait Grid



Geological Processes

World Investigations

Geologic Area		Quadrant
1	Himalayas	(4, 3)
2	Surtsey	(-1, 7)
3	Mid-Atlantic Ridge	(-1, 1)
4	Andes Mountains	(-3, 0)
5	Iceland Weathering	(-1, 8)
6	Qinghai-Tibetan Plateau	(4, 3)
7	Niagara Falls	(-4, 5)
8	Antarctica	(-6, -7)
9	Grand Canyon	(-5, 4)

United States Investigations

Geologic Area		Quadrant
1	San Andreas Fault	(-8, 0)
2	Rocky Mountains	(-5, 2)
3	Mesa – Glass Mountains	(-1, -2)
4	Mount St. Helens	(-8, 7))
5	Yellowstone National Park	(-5, 4)
6	Appalachian Mountains	(4, -2)
7	Mississippi River Basin/Delta	(2, -6)
8	Crater Lake	(-8. 6)
9	Grand Canyon	(-6, -1)

Utah Investigations

Geologic Area		Quadrant
1	Arches National Park	(-7, 4)
2	Little Cottonwood Canyon	(0, 4)
3	Great Salt Lake	(-3, 5)
4	Hoodoos - Bryce Canyon National Park	(-2, -6)
5	Thistle Landslide	(1, 1)
6	Capitol Reef National Park	(1, -4)
7	Bonneville Salt Flats	(-7, 4)
8	Dinosaur National Monument	(7, 3)
9	Grand Canyon	(-2, 9)

Remember: The x-coordinate tells the distance right (positive) or left (negative). The y-coordinate tells the distance up (positive) or down (negative).

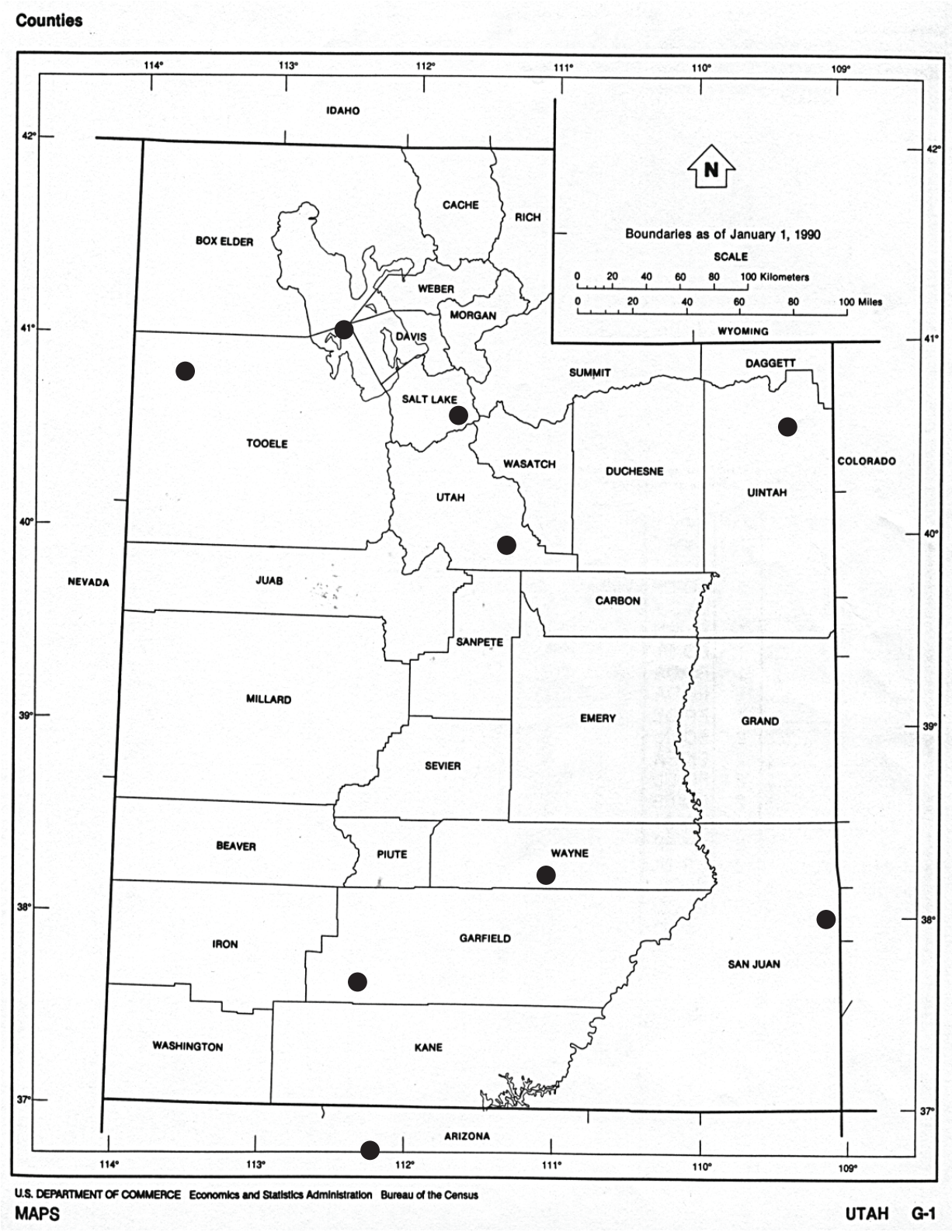
Research Lists

Research List – World		
World 1	Himalayas	http://en.wikipedia.org/wiki/Himalayas
World 2	Surtsey	http://en.wikipedia.org/wiki/Himalayas
World 3	Mid-Atlantic Ridge	http://en.wikipedia.org/wiki/Mid-Atlantic_Ridge
World 4	Andes	http://en.wikipedia.org/wiki/Andes
World 5	Iceland Weathering	http://en.wikipedia.org/wiki/Weathering
World 6	Qinghai-Tibetan Plateau	http://en.wikipedia.org/wiki/Plateau http://en.wikipedia.org/wiki/Chang_Tang
World 7	Niagara Falls	http://en.wikipedia.org/wiki/Niagara_Falls
World 8	Antarctica	http://en.wikipedia.org/wiki/Anarctica
All Teams	Grand Canyon	http://en.wikipedia.org/wiki/Grand_Canyon

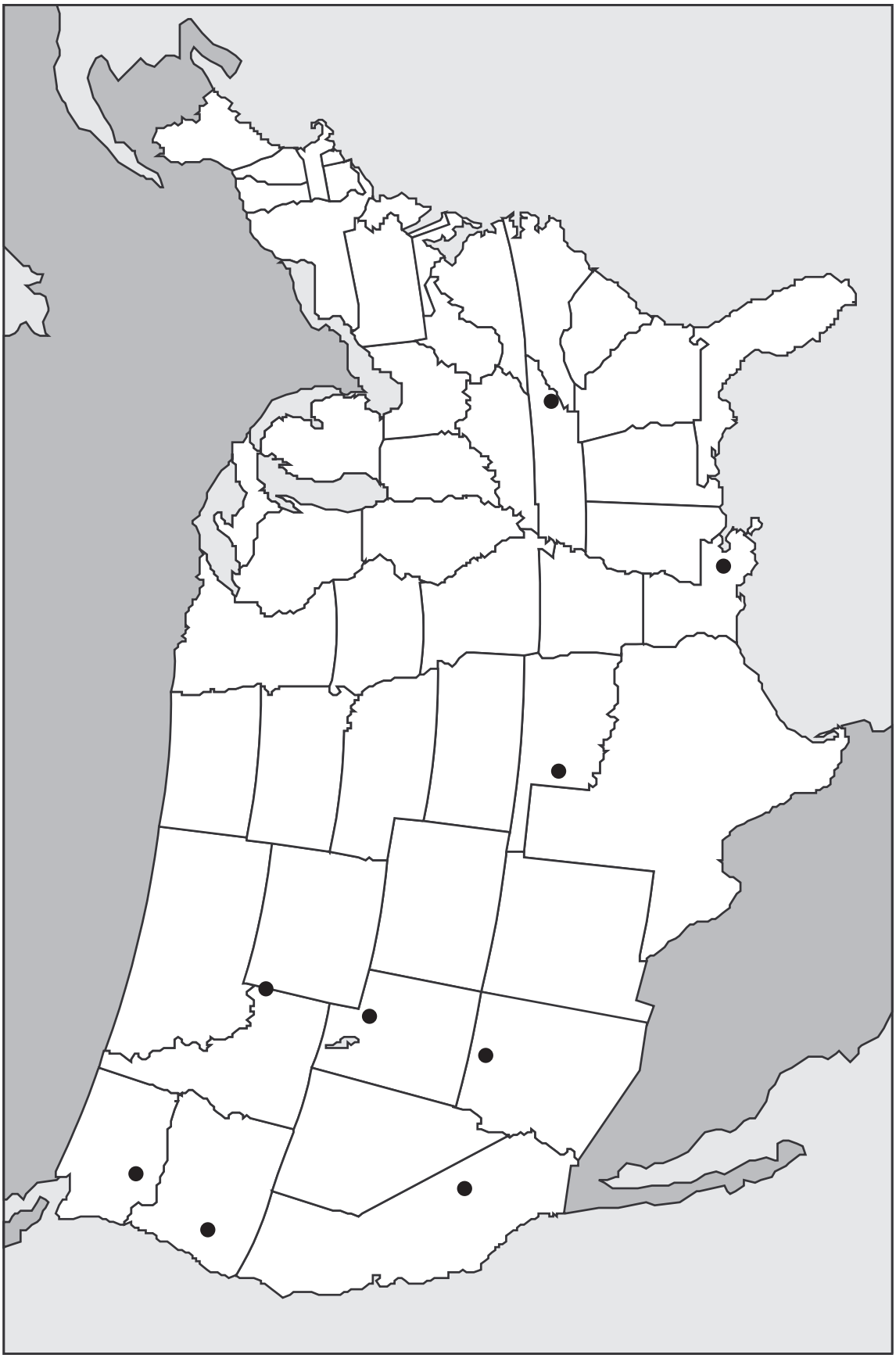
Research List – United States (U.S.)		
U.S. 1	San Andreas Fault	http://en.wikipedia.org/wiki/San_Andreas_Fault
U.S. 2	Rocky Mountains	http://en.wikipedia.org/wiki/Rocky_Mountains
U.S. 3	Mesa – Glass Mountains	http://en.wikipedia.org/wiki/Mesa
U.S. 4	Mount St. Helens	http://en.wikipedia.org/wiki/Mt._St._Helens
U.S. 5	Yellowstone National Park	http://en.wikipedia.org/wiki/Yellowstone_National_Park
U.S. 6	Appalachian Mountains	http://en.wikipedia.org/wiki/Appalachian_Mountains
U.S. 7	Mississippi River Basin	http://en.wikipedia.org/wiki/Mississippi_River
U.S. 8	Crater Lake	http://en.wikipedia.org/wiki/Crater_Lake
All Teams	Grand Canyon	http://en.wikipedia.org/wiki/Grand_Canyon

Research List - Utah		
Utah 1	Arches National Park	http://en.wikipedia.org/wiki/Arches_National_Park
Utah 2	Little Cottonwood Canyon	http://en.wikipedia.org/wiki/Little_Cottonwood_Canyon
Utah 3	Great Salt Lake	http://en.wikipedia.org/wiki/Great_Salt_Lake
Utah 4	Hoodoos (Bryce Canyon National Park)	http://en.wikipedia.org/wiki/Hoodoo_%28geology%29
Utah 5	Thistle Landslide	http://en.wikipedia.org/wiki/Thistle,_Utah
Utah 6	Capitol Reef National Park	http://en.wikipedia.org/wiki/Capitol_Reef_National_Park
Utah 7	Bonneville Salt Flats	http://en.wikipedia.org/wiki/Bonneville_Salt_Flats
Utah 8	Dinosaur National Monument	http://en.wikipedia.org/wiki/Dinosaur_National_Monument
All Teams	Grand Canyon	http://en.wikipedia.org/wiki/Grand_Canyon

Utah Map


Counties
114°
113°
112°
111°
110°
109°
42°
41°
40°
39°
38°
37°
IDAHO
WYOMING
COLORADO
NEVADA
ARIZONA
N
Boundaries as of January 1, 1990
SCALE
0 20 40 60 80 100 Kilometers
0 20 40 60 80 100 Miles
BOX ELDER
CACHE
RICH
WEBER
MORGAN
DAVIS
SALT LAKE
SUMMIT
DAGGETT
TOOELE
UTAH
WASATCH
DUCHESNE
UINTAH
JUAB
CARBON
SANPETE
MILLARD
EMERY
GRAND
SEVIER
BEAVER
PIUTE
WAYNE
IRON
GARFIELD
SAN JUAN
WASHINGTON
KANE
U.S. DEPARTMENT OF COMMERCE Economics and Statistics Administration Bureau of the Census
MAPS
UTAH G-1

United States Map



World Map

Geological Processes

Standard II:

Students will understand that volcanoes, earthquakes, uplift, weathering, and erosion reshape Earth's surface.

Objective 2:

Explain how volcanoes, earthquakes, and uplift affect Earth's surface.

Objective 3:

Relate the building up and breaking down of Earth's surface over time to the various physical land features.

Intended Learning Outcomes:

1. Use science process and thinking skills
2. Manifest scientific attitudes and interests
4. Communicate effectively using science language and reasoning

Content Connections:

Life Skills; Thinking and Reasoning.

Science Standard II

Objectives 2 & 3

Connections

Background Information

Earth's surface is constantly changing. Some changes happen very slowly over long periods of time, such as weathering, erosion, and uplift. Other changes happen abruptly, such as landslides, volcanic eruptions, and earthquakes. All around us, we see the visible effects of the building up and breaking down of Earth's surface.

This activity is designed as a game board that will allow students to deepen their understanding of the effects of weathering, erosion; uplift, sudden changes (e.g. flash flood, avalanche), earthquakes and volcanoes on the geological features of Earth. In this activity students will use a geological processes gameboard and game cue cards to try and build the biggest mountain. The game cue cards use science vocabulary and help students understand the impact of geological forces on the features of Earth's surface.

Research Basis

Balasubramanian, N., Wilson, B. G., & Cios, K. J. (2005) *Games and Simulations* Retrieved January 5, 2008, from http://site.aace.org/pubs/foresite/GamesAndSimulations1.pdf

This paper examines the opportunities and challenges that games can offer to enrich teaching and learning. Research is based on games developed by the Nobel games. Five guidelines are recommended for games to be meaningful and integrated into the classroom setting.

Teed, R. *Game-based Learning*. Retrieved January 5, 2008, from http://serc.carleton.edu/introgeo/games/index.html

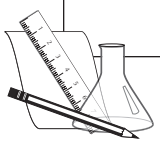
This is an excellent resource for developing and creating games for the classroom. Elements that comprise well-developed games are explored. Information is based on current research.

Hogle, J. (1996-08-00) *Considering Games as Cognitive Tools: In Search of Effective "Edutainment"* ERIC #: ED425737 Retrieved January 5, 2008, from http://twinpinefarm.com/pdfs/games.pdf

This research paper reviews proposed benefits of using games as cognitive tools. Researchers have purported that the use of educational games has the potential to increase interest, motivation and retention, as well as improve higher order thinking and reasoning skills. This paper reviews the benefits of games and what is needed in order for games to be of value in the education setting.

Materials

- ❑ *Gameboard Cards*
- ❑ *Gameboard*
- ❑ Foam Dice
- ❑ Centimeter cubes or counters
- ❑ Utah Relief Map
- ❑ National Atlas Relief Map
- ❑ The Dynamic Planet Map



Invitation to Learn

Invite students to look at the Dynamic Planet Map. Facilitate discussion with the following questions: (Allow time for discussion and reflection).

- What do all the dots mean on the map?
- Why do you think that a lot of earthquakes and volcanoes are where they are on the map?
- Why do you think they call the area around the Pacific Ocean the "Ring of Fire?"
- What geological feature do you find at plate boundaries? (Mountains, volcanoes)
- What forces build up a mountain?
- What forces can break down Earth?
- What does erosion do to Earth's surface?
- Where do all the rivers drain?
- What role does water play in sculpting the surface of Earth?

Inform students that these are all geological processes. In order to deepening their understanding of how these processes impact Earth's surface, invite them to play the Geological Processes Game. Challenge them to be the one to build the biggest mountain.

Instructional Procedures

1. Students will get into teams of 4 or less. Each team will need a *Gameboard*, *Gameboard Cards*, one die (foam or other) and

container of centimeter cubes (about 120). If centimeter cubes are not available paper, counters or another pattern blocks can be used.

2. Directions for how to play the game are on the gameboard. Remind students they are to move in a forward (not backward) direction. Some adaptations (if needed):
   - Use a timer to identify length of playing time.
   - If area on gameboard is too small to build on, have students build on a piece of paper.
   - Students may need to count out their mountain pieces if a clear winner cannot be established.
   - Students might be able to work as teams if needed in order for all students to participate.
3. After game time has ended, have students return supplies to designated area. Initiate a group discussion about what they learned about geological processes as they played the game. In a journal or on the board, allow students to list several of their ideas about concepts they learned from doing this activity. Develop the idea that geological forces of erosion and uplift are responsible for much of Earth's features. Have students identify different types of erosion (wind, water) and weathering (mechanical – root pry, freezing and thawing; chemical weathering).
4. Review major concepts (volcanoes, earthquakes, uplift, weathering, and erosion reshape Earth's surface.)
5. To extend the activity have students view the Utah Relief Map, National Atlas Relief Map or the Dynamic Planet Map and see if they can find places on Earth where erosion (drainage basins), uplift (mesas, plateaus), volcanoes and earthquakes (Ring of Fire, plate tectonics) and deposition (deltas) have occurred.

Assessment Suggestions

- Participation in a team and successfully building a mountain.
- Group discussion participation and recorded list of main concepts.
- Ability to locate areas on map, explain what geologic feature is located in that area and what geologic forces impacted that area.
- Extension: Invite students to make more game cue cards with additional geologic processes, or have them write in a science

journal or notepad ideas for cards to be added to the geological processes cue cards.

Curriculum Extensions/Adaptations/ Integration

- Adaptations for learners with special needs: Have student work with a partner so they can play the game without limitations.
- Have a team competition and see who can build the biggest mountain.
- Social Studies Connection – Read about the 1906 San Francisco Earth, Mount St. Helens, Hurricane Katrina or other major disasters and examine what impact the geologic features of Earth had on that event.

Family Connections

- Provide each student with a gameboard and blacklines of the gameboard cards. Invite them to play the game at home.
- Have a classroom set of the *Geological Processes* gameboard available to use when appropriate time is available.
- Have a team competition and see who can build the biggest mountain.

Additional Resources

Web sites

Mountain Building/Orogeny Visualizations http://serc.carleton.edu/NAGTWorkshops/visualization/collections/orogeny.html

Natural Wonders of the World Field Trip http://www.field-guides.com/sci/natwon/

Plate Tectonics http://scign.jpl.nasa.gov/learn/plate.htm

Gameboard Cards

Geological Process	Earthquake Card A 3.2 earthquake caused uplift in your area. Add 4 units to your mountain.

Geological Process	Earthquake Card A 7.0 earthquake caused uplift in your area. Add 6 units to your mountain.

Geological Process	Landslide in your area from heavy rain. Remove 2 units from your mountain.

Geological Process	Landslide in your area eroded an entire hillside. Remove 4 units.

Geological Process	Volcanic eruption, molten lava added to your mountain. Add 10 units.

Geological Process	Wind and water erosion have removed material from an arch area and it collapsed. Remove 1 unit.

Geological Process	Plate movement has caused uplift – add 2 units.

Geological Process	Geologists have just discovered ancient evidence that your area was uplifted. Add 5 units.

Geological Process	Avalanche caused a huge area to move down the mountain. Remove 3 units.

Geological Process	A huge plate movement caused immediate uplift. Add 10 units.

Geological Process	A large area uplifted and formed a plateau (or mesa). Add 3 units.

Geological Process	Earthquake Card A 2.2 earthquake caused rockslides. Remove 2 units.

Geological Process	An ancient glacier moved through your mountain causing a U shaped valley. Remove 2 units.

Geological Process	Two plates are moving away from each other creating a valley. Remove 3 units from mountain.

Geological Process	Two plates are pushing together creating a higher mountain. Add 2 units.

Geological Process	**Bonus Card (10 units)** Because you understand earthquakes, volcanoes and uplift cause a mountain to get bigger.

Geological Process	Earthquake Card A 1.2 earthquake caused very little uplift. Add 1 unit to your mountain.

Geological Process	A river cut between mountains forming a V-shape valley. Remove 2 units.

Geological Process	Avalanche reported. Erosion happened. Remove 2 units.

Geological Process	Wind erosion has been removing soil from the top of the mountain. Remove 1 unit.

Geological Process	A large area uplifted and formed a plateau (or mesa). Add 3 units.

Geological Process	Flash Flood – water removed soil. Remove 2 units.

Geological Process	Tectonic forces are causing your mountain to uplift. Add 2 units.

Geological Process	No weathering, erosion, or uplift has taken place. Your mountain does not change.

Geological Process	Two plates are pushing together creating a higher mountain. Add 5 units.

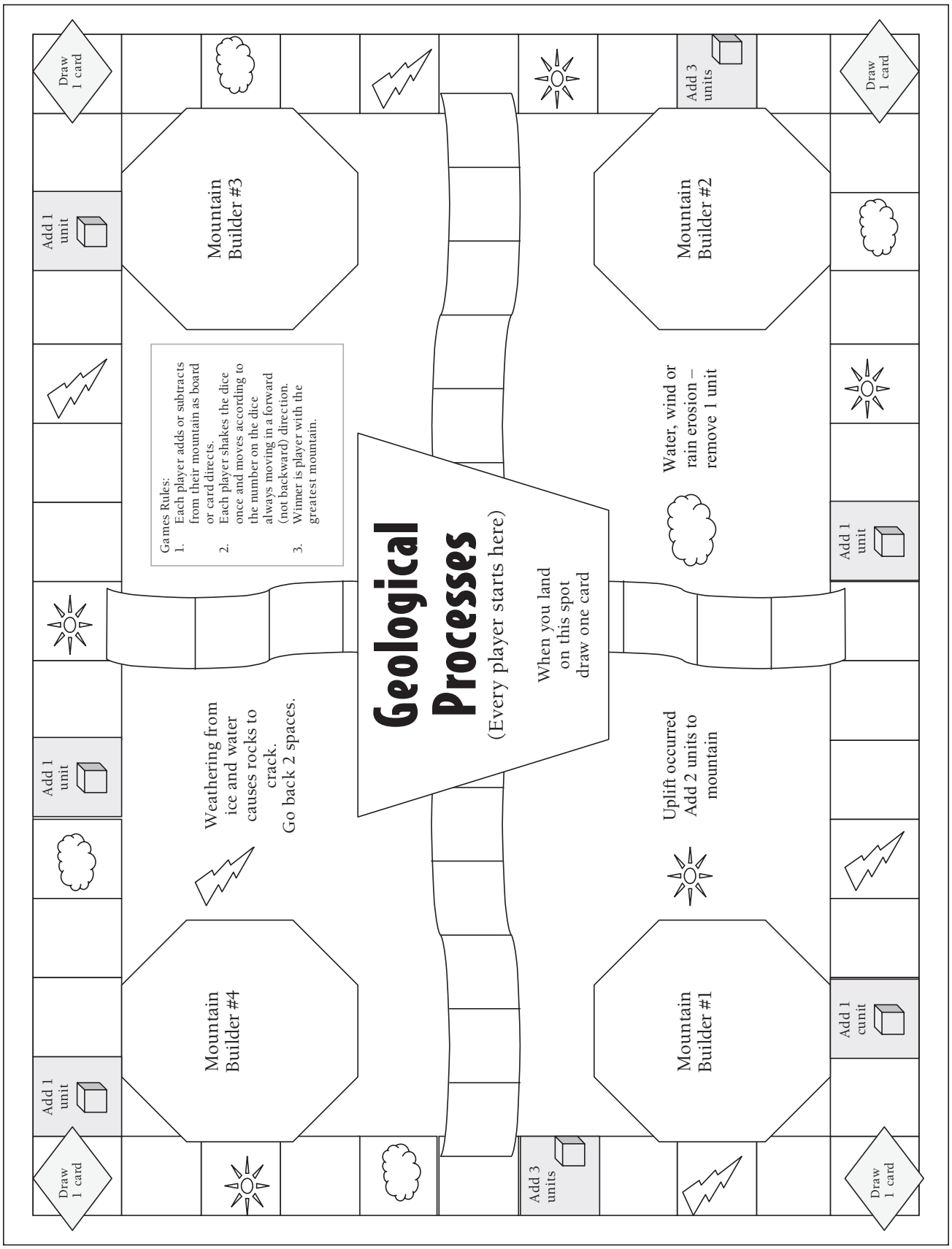
Geological Process	No weathering, erosion, or uplift has taken place. Your mountain does not change.

Geological Process	Deposition Card Several rivers have carried soil down the mountain from a river. Remove 2 units.

Geological Process	No weathering, erosion, or uplift has taken place. Your mountain does not change.

Geological Process	Deposition Card Several rivers have carried soil down the mountain from a river. Remove 2 units.

Geological Process	Rock samples show that mountain folding has taken place. Add 2 units.


Geological Processes
(Every player starts here)
When you land on this spot draw one card
Games Rules:
1. Each player adds or subtracts from their mountain as board or card directs.
2. Each player shakes the dice once and moves according to the number on the dice always moving in a forward (not backward) direction.
3. Winner is player with the greatest mountain.
Mountain Builder #3
Mountain Builder #2
Mountain Builder #4
Mountain Builder #1
Weathering from ice and water causes rocks to crack. Go back 2 spaces.
Uplift occurred Add 2 units to mountain
Water, wind or rain erosion – remove 1 unit
Draw 1 card
Add 1 unit
Add 3 units

Appendix

MATH Journal Table of Contents

Subject	Pg.	Subject	Pg.
1		11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	

SCIENCE Journal Table of Contents

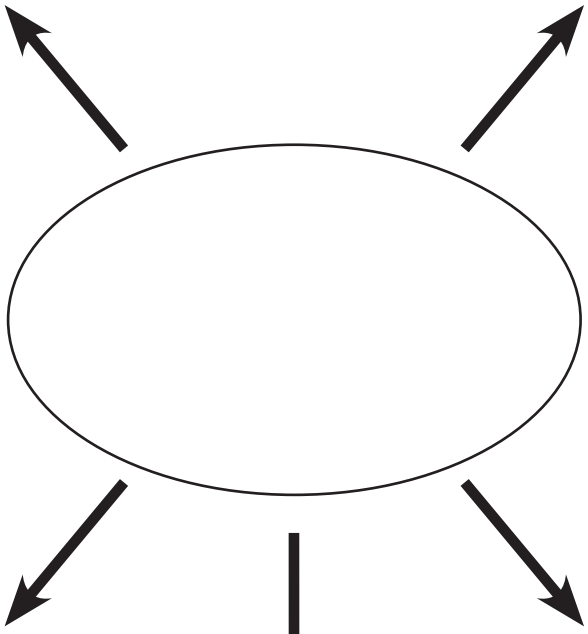
Subject	Pg.	Subject	Pg.
1		11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	

Zooming In

Most Important

Least Important

Would no expect



Zooming Out

Similar to

Related Ideas

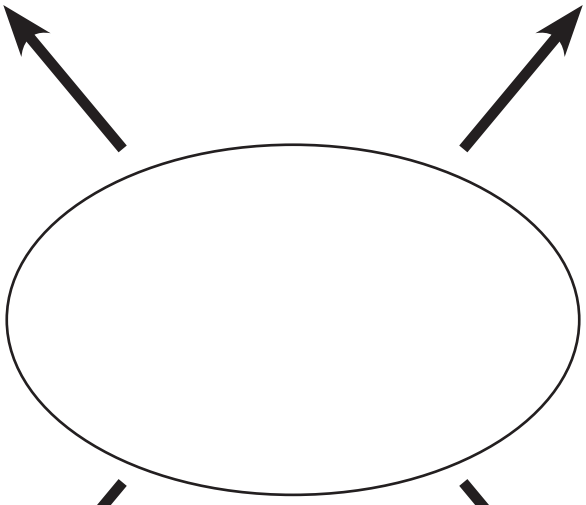
Summary Statement

Zooming In

Most Important

Least Important

Would no expect



Zooming Out

Similar to

Related Ideas

Summary Statement

Name _____ Date _____

NIPS

N = Note-taking
I = Interacting
P = Prioritizing
S = Summarizing

List of Priorities

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

Summarization

_____

_____

_____

_____

_____

_____

From Susan Davis Lenski, Mary Ann Wham, and Jerry L. Johns, *Reading & learning Strategies: Middle Grades through High School, 2nd Edition. Copyright 2003.*

Name _____ Date _____

NIPS

N = Note-taking
I = Interacting
P = Prioritizing
S = Summarizing

List of Priorities

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

Summarization

_____

_____

_____

_____

_____

_____

From Susan Davis Lenski, Mary Ann Wham, and Jerry L. Johns, *Reading & learning Strategies: Middle Grades through High School, 2nd Edition. Copyright 2003.*

Analyze It and Sell It!

Name of Activity: _____

Main Purpose of Activity: _____

Describe how it works: _____

_____

_____

_____

What types of text/content would it be most suited for? _____

_____

Is it flexible? Yes or No? Why? _____

_____

Rate its Effectiveness: (1 = Terrible! – 10 = So great, I'll use it weekly!)

1 2 3 4 5 6 7 8 9 10

Analyze It and Sell It!

Name of Activity: _____

Main Purpose of Activity: _____

Describe how it works: _____

_____

_____

_____

What types of text/content would it be most suited for? _____

_____

Is it flexible? Yes or No? Why? _____

_____

Rate its Effectiveness: (1 = Terrible! – 10 = So great, I'll use it weekly!)

1 2 3 4 5 6 7 8 9 10

Planning a Vacation #1

Addition and Subtraction

My Weekend Vacation

I would like to take a weekend vacation down to Salt Lake City with my husband. Here is what I need you to figure out:

- We need to stay for two nights, so I need two nights lodging at a hotel.
- We need to eat one meal on Friday night, three meals on Saturday and three meals on Sunday.
- We need some entertainment.
- I don't want to spend more than $400.00 total.

CHOICES:

Hotels (Prices are per night. Remember that I need two nights. The stars tell you how nice of a hotel it is—the more stars, the nicer the place!)

Best Western	74.00 ***
Crystal Inn	65.00 ** ½ *
Super 8	49.00 **
Marriott	98.00 ****
Comfort Inn	59.00 ** ½ *

Entertainment (Prices are per event—it is the cost for both of us to do it.)

Shopping	??? – You decide how much we get to spend!
Movie	15.00
Broadway Show	100.00
Lagoon	50.00
Clark Planetarium	20.00
Hogle Zoo	25.00

Food (Prices are per meal—it is enough money for both of us to eat.)

Fast food	12.00 (Subway, McDonalds, etc.)
Mid-grade	20.00 (Chili's, Appleby's, Ruby Tuesday etc.)
Expensive	30.00 (Olive Garden, Red Lobster etc.)
High Class	40.00 (Café Pierpont, etc.)

Look on nest page for an
Example of what you should turn in!

Example of what you should turn in:

Hotel:	
Friday night – Super 8	49.00
Saturday night – Super 8	49.00
TOTAL	98.00
Food:	
Friday Dinner – mid-grade	20.00
Saturday Breakfast – fast	12.00
Lunch - fast	12.00
Dinner – fast	12.00
Sunday Breakfast – mid	20.00
Lunch - expensive	30.00
Dinner – mid	20.00
TOTAL	94.00
Entertainment:	
Lagoon	50.00
Broadway Show	100.00
Movie	15.00
Zoo	25.00
TOTAL	190.00
GRAND TOTAL:	382.00

MY VACATION PLANS

According to _____:

Hotel:

Friday night – _____ _____

Saturday night – _____ _____

TOTAL _____ _____

Food:

Friday Dinner – _____ _____

Sat. Breakfast – _____ _____

Lunch – _____ _____

Dinner – _____ _____

Sun. Breakfast – _____ _____

Lunch – _____ _____

Dinner – _____ _____

TOTAL _____ _____

Entertainment:

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

TOTAL _____

GRAND TOTAL: _____

Planning a Vacation #2

Addition, Subtraction and Decimals

My Weekend Vacation

I would like to take a weekend vacation down to Salt Lake City with my husband. Here is what I need you to figure out:

- We need to stay for two nights, so I need two nights lodging at a hotel.
- We need to eat one meal on Friday night, three meals on Saturday and three meals on Sunday.
- We need some entertainment.
- I don't want to spend more than $400.00 total.

CHOICES:

Hotels (Prices are per night. Remember that I need two nights. The stars tell you how nice of a hotel it is—the more stars, the nicer the place!)

Best Western	74.50 ***
Crystal Inn	65.85 ** ½ *
Super 8	49.25 **
Marriott	98.99 ****
Comfort Inn	59.30 ** ½ *

Entertainment (Prices are per event—it is the cost for both of us to do it.)

Shopping	??? – You decide how much we get to spend!
Movie	15.75
Broadway Show	100.20
Lagoon	50.05
Clark Planetarium	20.34
Hogle Zoo	25.19

Food (Prices are per meal—it is enough money for both of us to eat.)

Fast food	12.06 (Subway, McDonalds, etc.)
Mid-grade	20.21 (Chili's, Appleby's, Ruby Tuesday etc.)
Expensive	30.09 (Olive Garden, Red Lobster etc.)
High Class	40.78 (Café Pierpont, etc.)

Look on next page for an
Example of what you should turn in!

Example of what you should turn in:

Hotel:	
Friday night – Super 8	49.00
Saturday night – Super 8	49.00
TOTAL	98.00
Food:	
Friday Dinner – mid-grade	20.00
Saturday Breakfast – fast	12.00
Lunch - fast	12.00
Dinner – fast	12.00
Sunday Breakfast – mid	20.00
Lunch - expensive	30.00
Dinner – mid	20.00
TOTAL	94.00
Entertainment:	
Lagoon	50.00
Broadway Show	100.00
Movie	15.00
Zoo	25.00
TOTAL	190.00
GRAND TOTAL:	382.00

MY VACATION PLANS

According to _____:

Hotel:

Friday night – _____ _____

Saturday night – _____ _____

TOTAL _____ _____

Food:

Friday Dinner – _____ _____

Sat. Breakfast – _____ _____

Lunch – _____ _____

Dinner – _____ _____

Sun. Breakfast – _____ _____

Lunch – _____ _____

Dinner – _____ _____

TOTAL _____ _____

Entertainment:

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

TOTAL _____

GRAND TOTAL: _____

Planning a Vacation #3

Addition, Subtraction, Multiply with Decimals

My Weekend Vacation

I would like to take a weekend vacation down to Salt Lake City with my husband and our two kids. Here is what I need you to figure out:

- We need to stay for two nights, so I need two nights lodging at a hotel.
- We need to eat one meal on Friday night, three meals on Saturday and three meals on Sunday.
- We need some entertainment.
- I don't want to spend more than $600.00 total.

CHOICES:

Hotels (Prices are per night. Remember that I need two nights. The stars tell you how nice of a hotel it is—the more stars, the nicer the place!)

Best Western	74.50 ***
Crystal Inn	65.85 ** ½ *
Super 8	49.25 **
Marriott	98.99 ****
Comfort Inn	59.30 ** ½ *

Entertainment (Prices are per event, per person—it is the cost for ONE of us to do it. You will need to do some multiplication to figure out how much it costs for all of us to do it!)

Shopping	??? – You decide how much we get to spend!
Movie	7.75
Broadway Show	48.20
Lagoon	39.95
Clark Planetarium	12.34
Hogle Zoo	17.49

Food (Prices are per meal, per person. Again there are FOUR of us eating at each meal. Figure accordingly! Hint: 4xeach meal price!)

Fast food	5.95 (Subway, McDonalds, etc.)
Mid-grade	11.21 (Chili's, Appleby's, Ruby Tuesday etc.)
Expensive	16.09 (Olive Garden, Red Lobster etc.)
High Class	21.78 (Rodizio Grill, etc.)

Look on next page for an
Example of what you should turn in!

Example of what you should turn in:

Hotel:	
Friday night – Super 8	49.00
Saturday night – Super 8	49.00
TOTAL	98.00
Food:	
Friday Dinner – mid-grade	20.00
Saturday Breakfast – fast	12.00
Lunch - fast	12.00
Dinner – fast	12.00
Sunday Breakfast – mid	20.00
Lunch - expensive	30.00
Dinner – mid	20.00
TOTAL	94.00
Entertainment:	
Lagoon	50.00
Broadway Show	100.00
Movie	15.00
Zoo	25.00
TOTAL	190.00
GRAND TOTAL:	382.00

MY VACATION PLANS

According to _____:

Hotel:

Friday night – _____ _____

Saturday night – _____ _____

TOTAL _____ _____

Food:

Friday Dinner – _____ _____

Sat. Breakfast – _____ _____

Lunch – _____ _____

Dinner – _____ _____

Sun. Breakfast – _____ _____

Lunch – _____ _____

Dinner – _____ _____

TOTAL _____ _____

Entertainment:

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

TOTAL _____

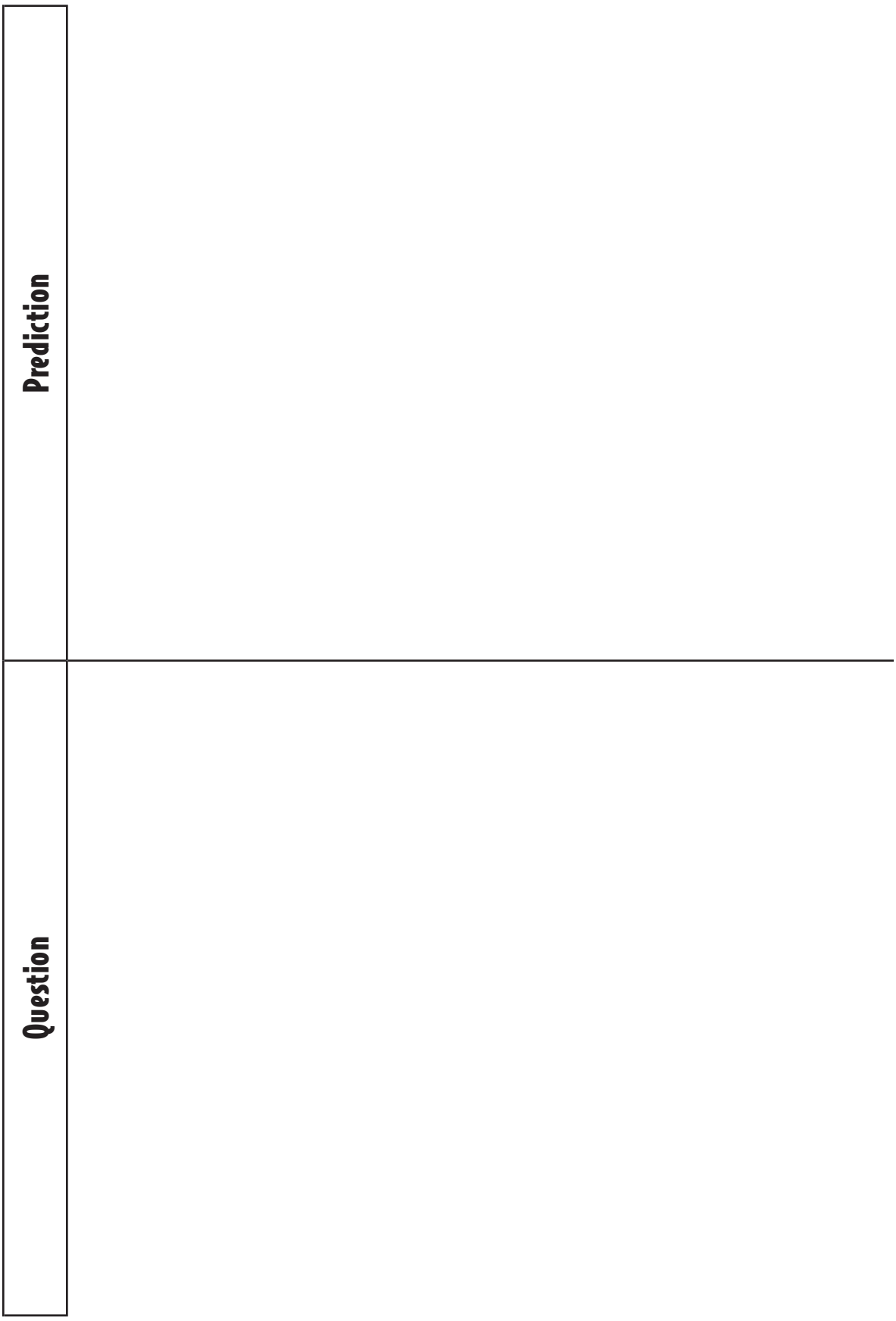
GRAND TOTAL: _____

4 Square

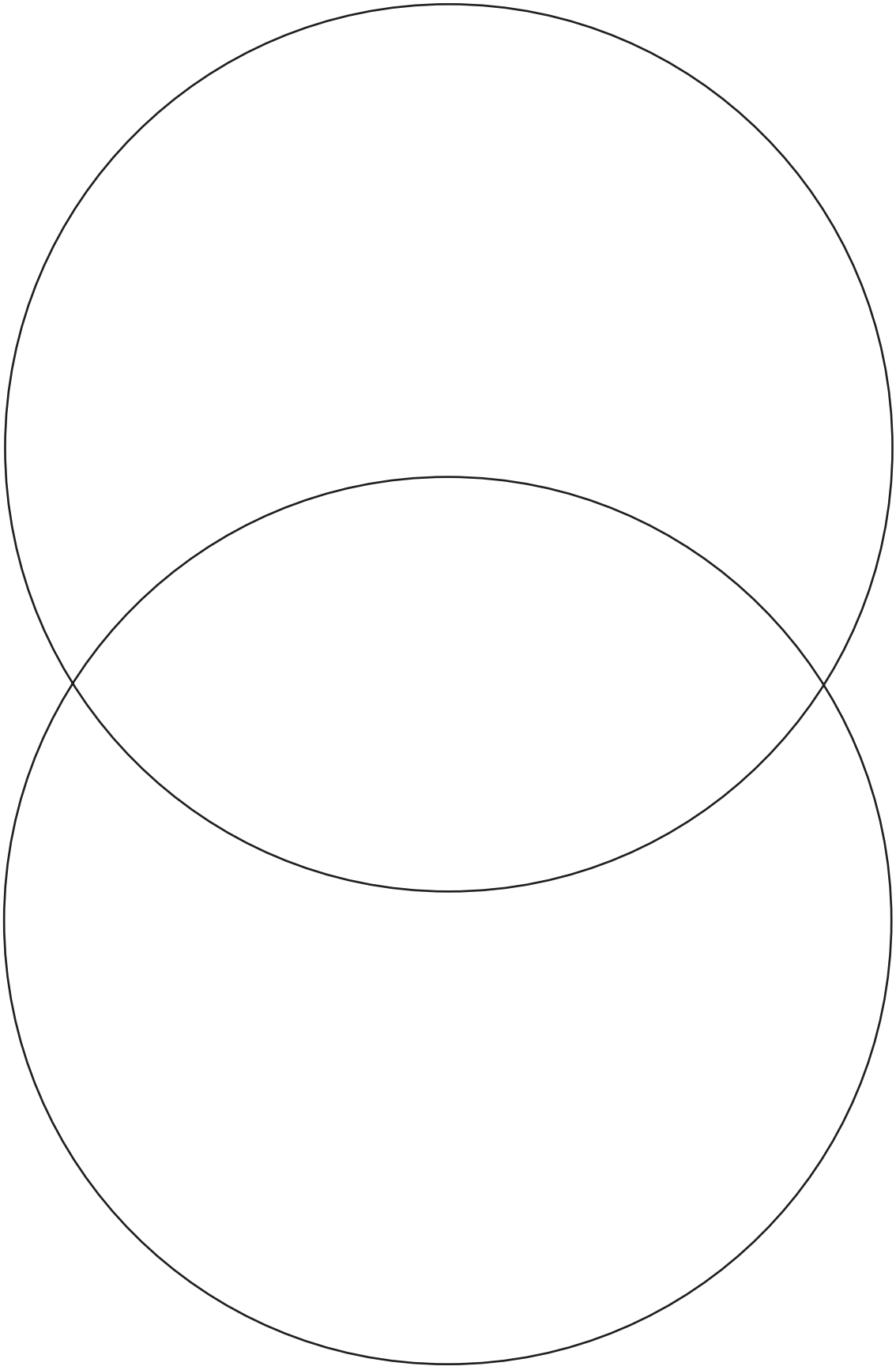
(Vocabulary Graphic Organizer)

Important Characteristics	Nonessential Characteristics
Examples	Not an Example of _____

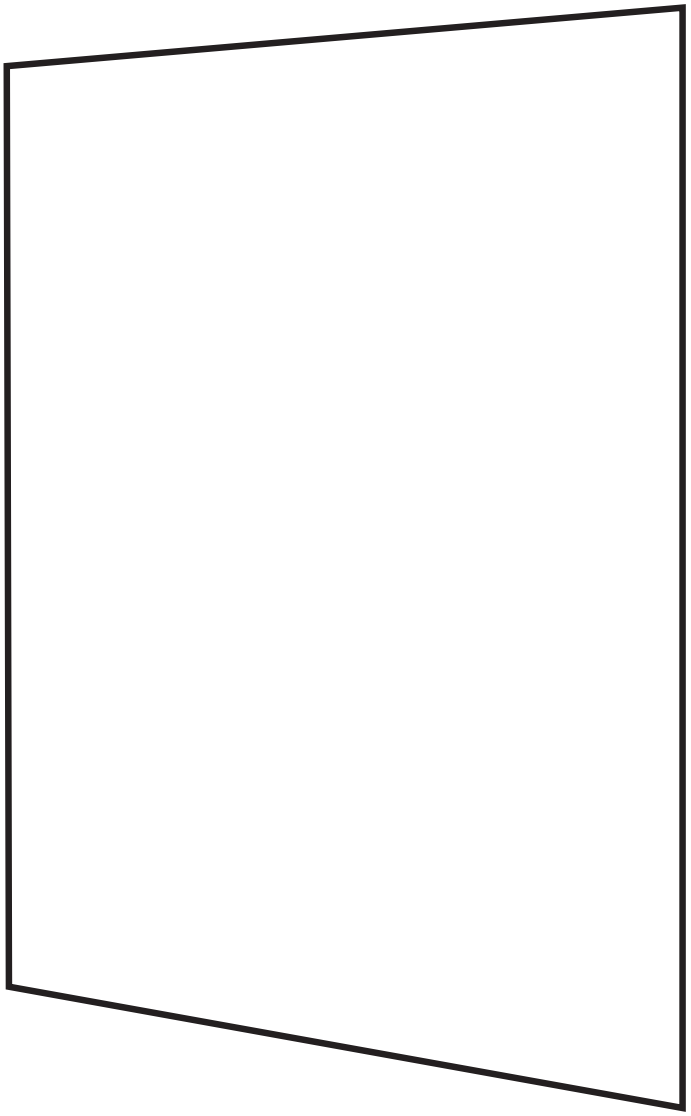
Question / Prediction Chart



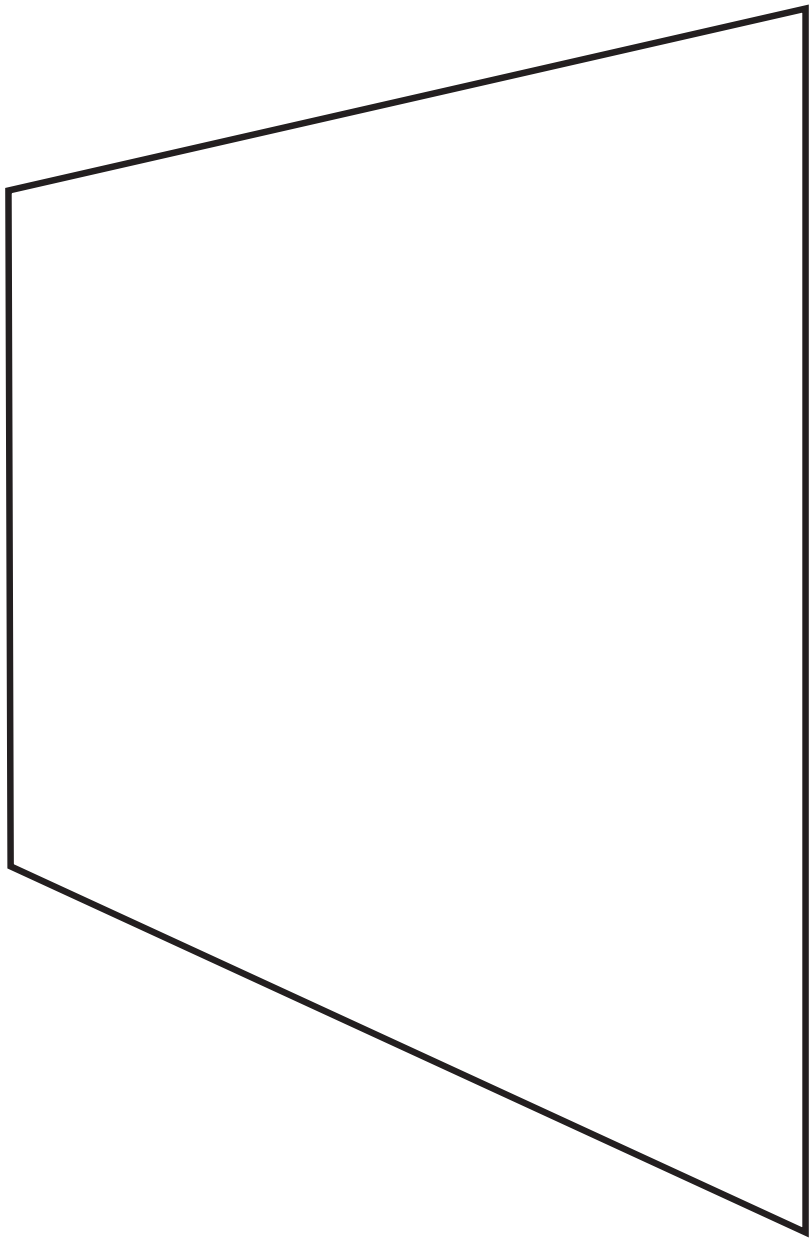
Venn Diagram



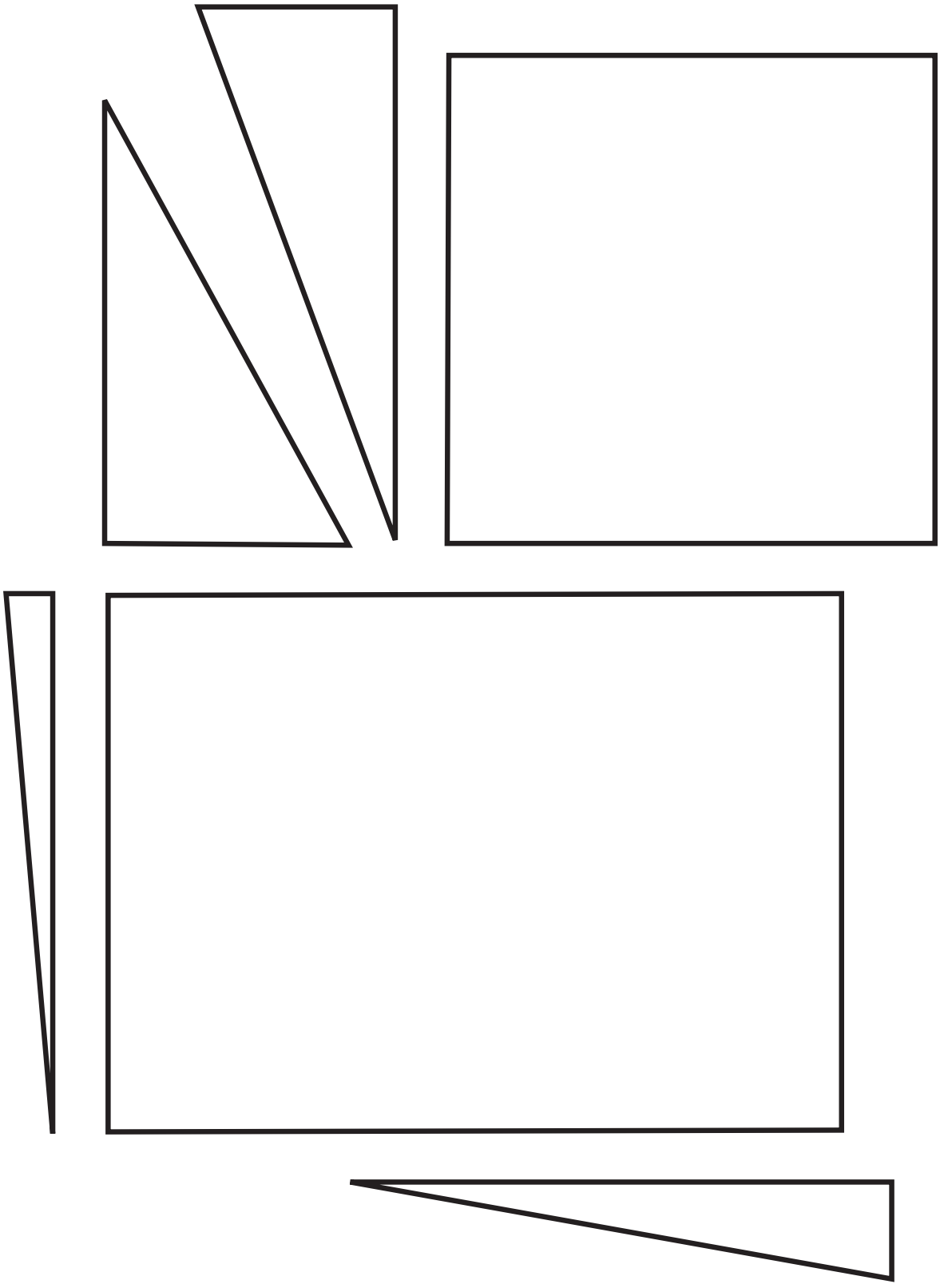
Trapezoid 1



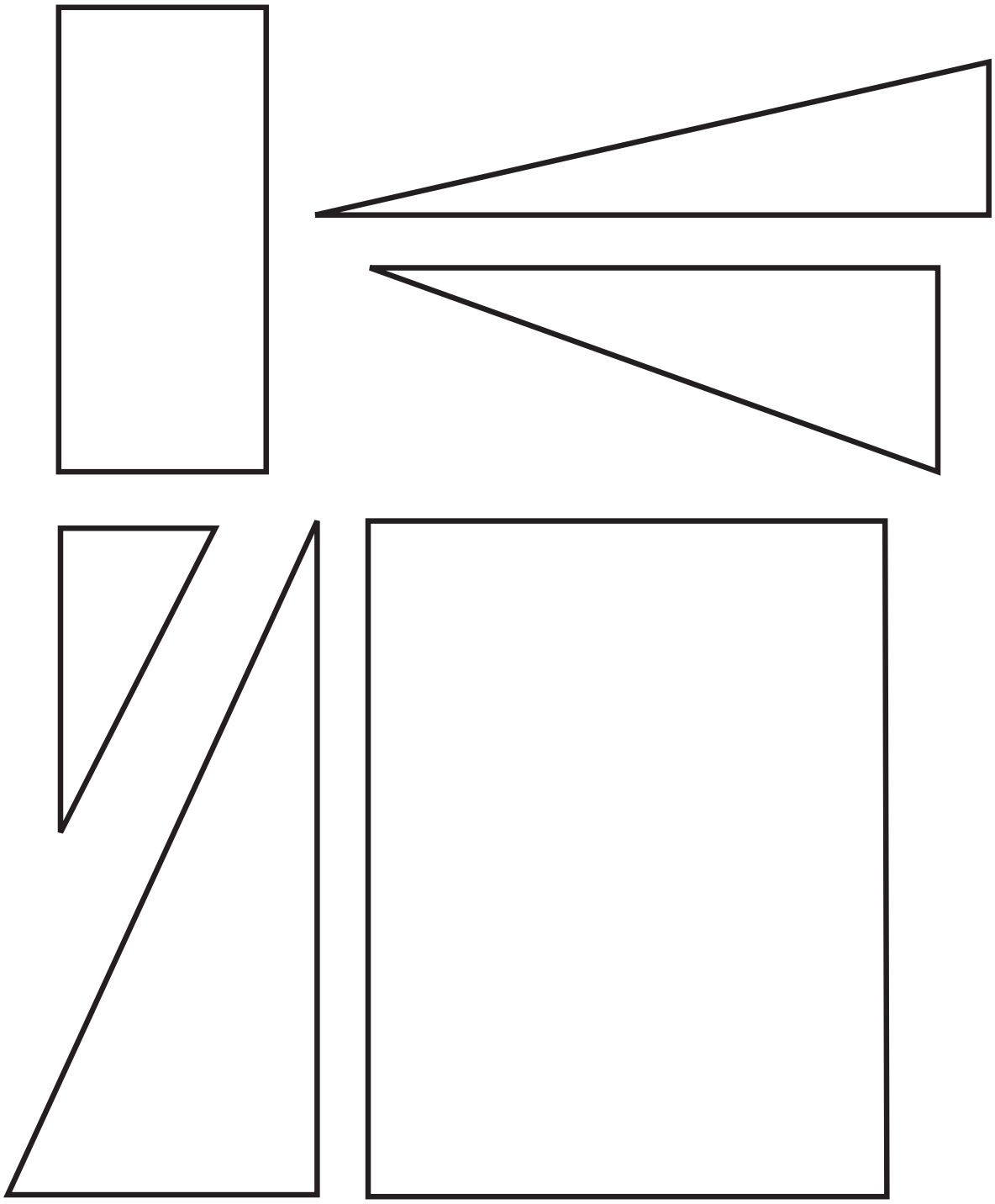
Trapezoid 2



Trapezoid Shapes 1



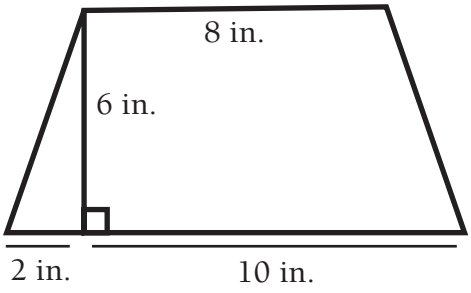
Trapezoid Shapes 2



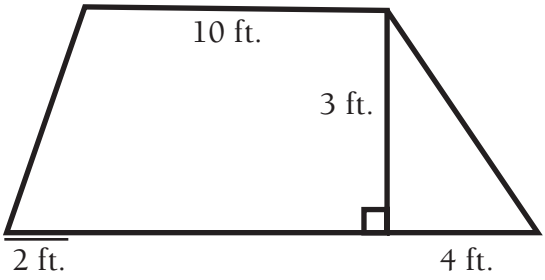
Trapezoid Assessment

Find the area of each trapezoid.

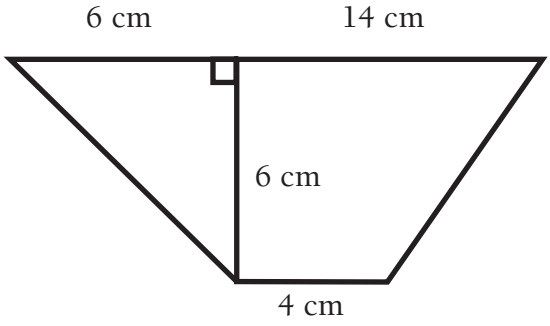
1.



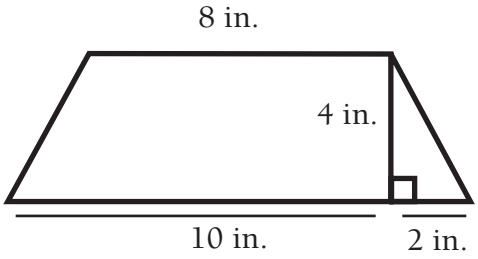
2.



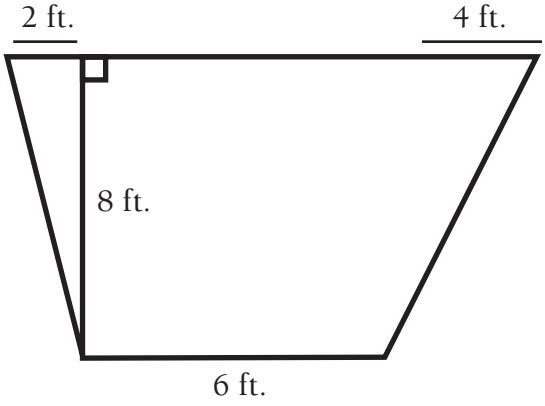
3.



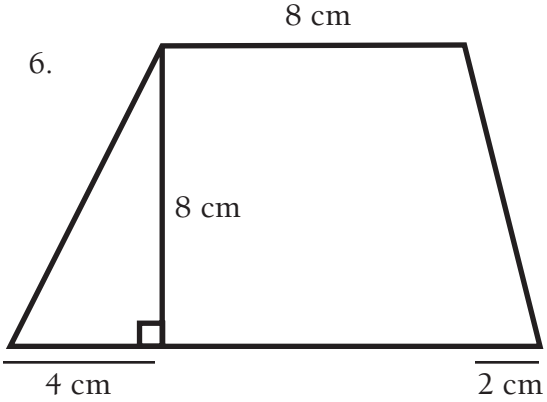
4.



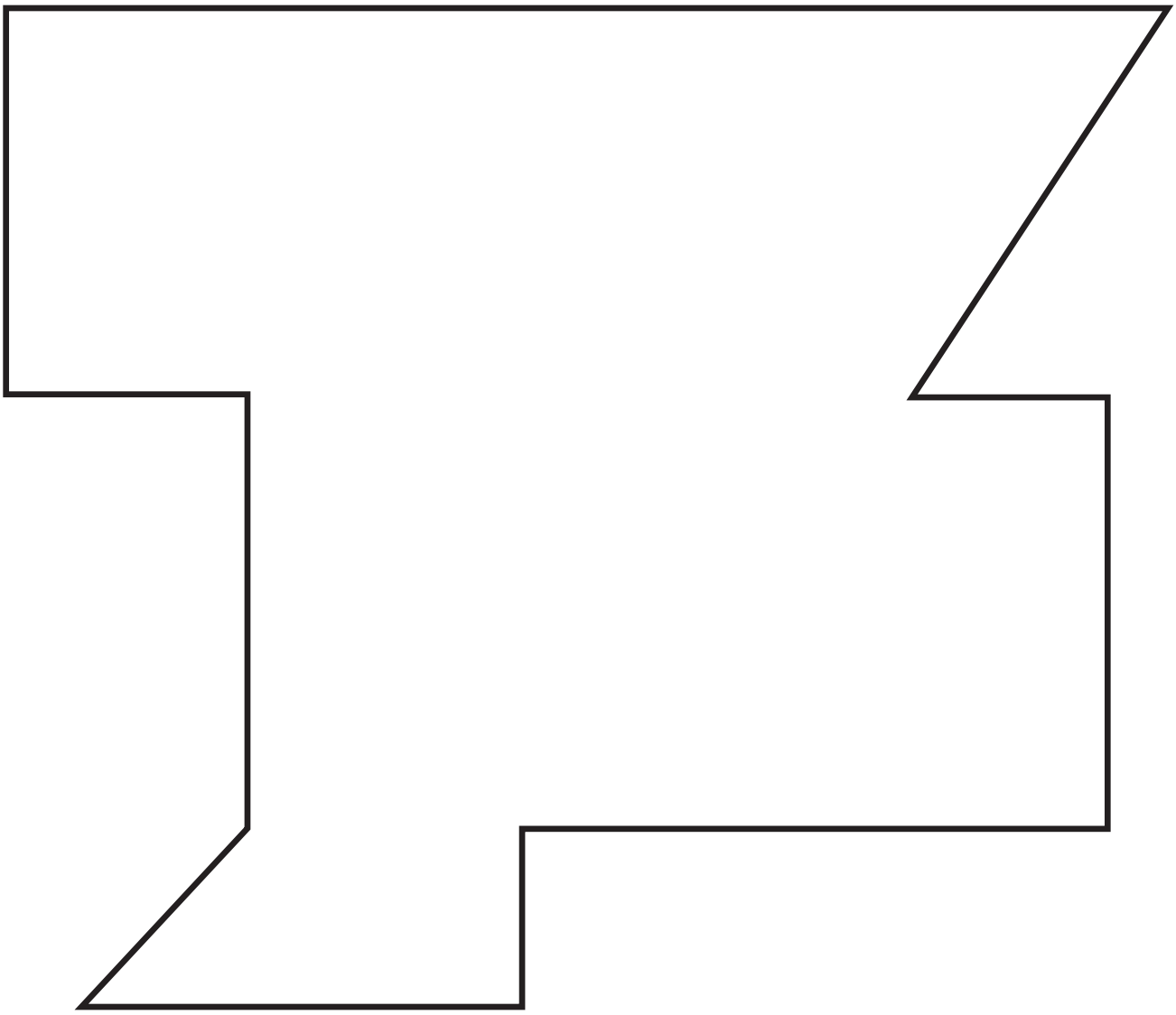
5.



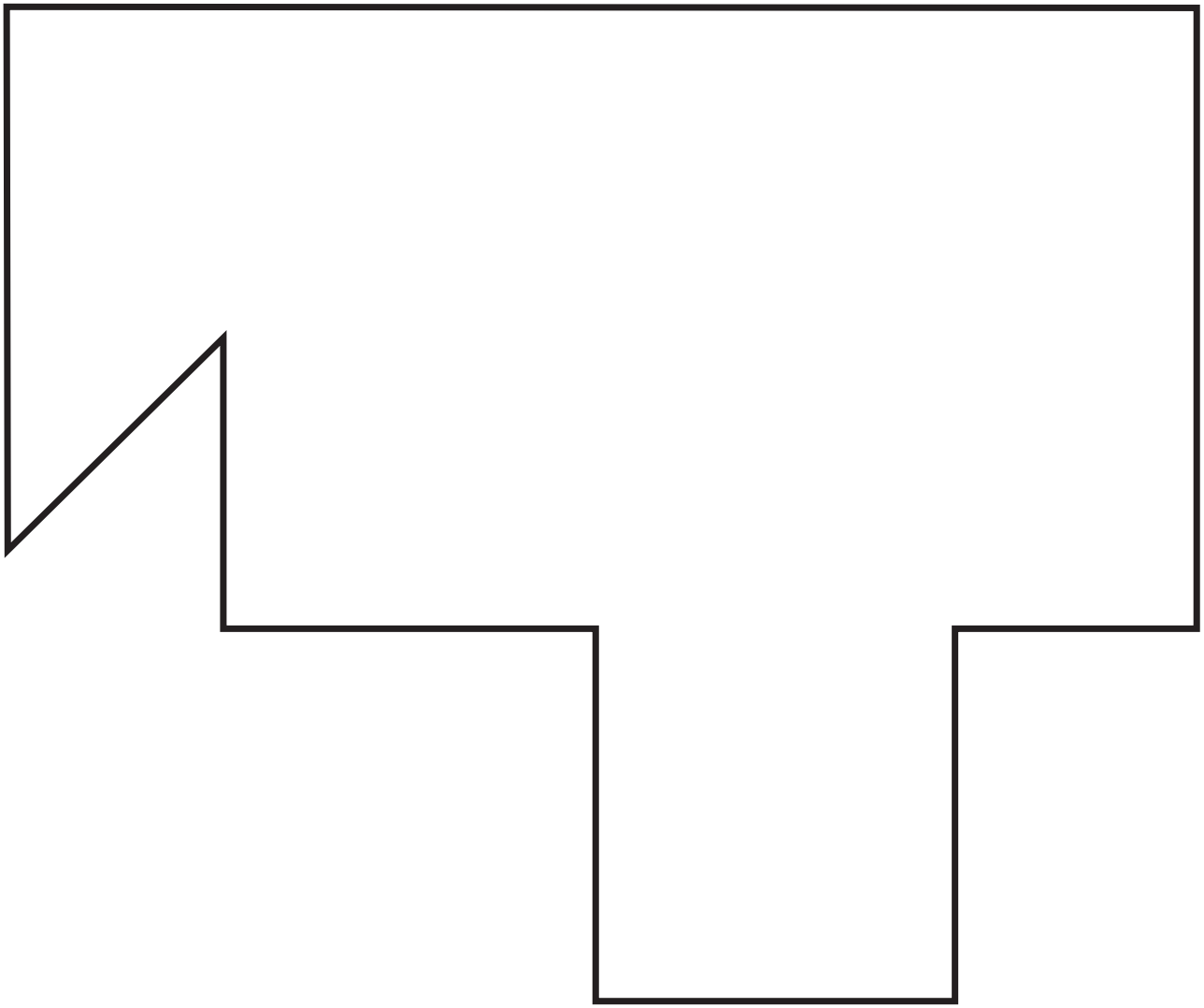
6.



Irregular Polygon 1



Irregular Polygon 2



Let's Build Boxes

	Length (cm)	Width (cm)	Height (number of layers of cubes)	Volume (number of cm cubes needed to fill box)
Box 1				
Box 2				
Box 3				
Box 4				

What patterns do you notice from the chart?

_____

_____

_____

_____

Is there an easier way to find volume?

_____

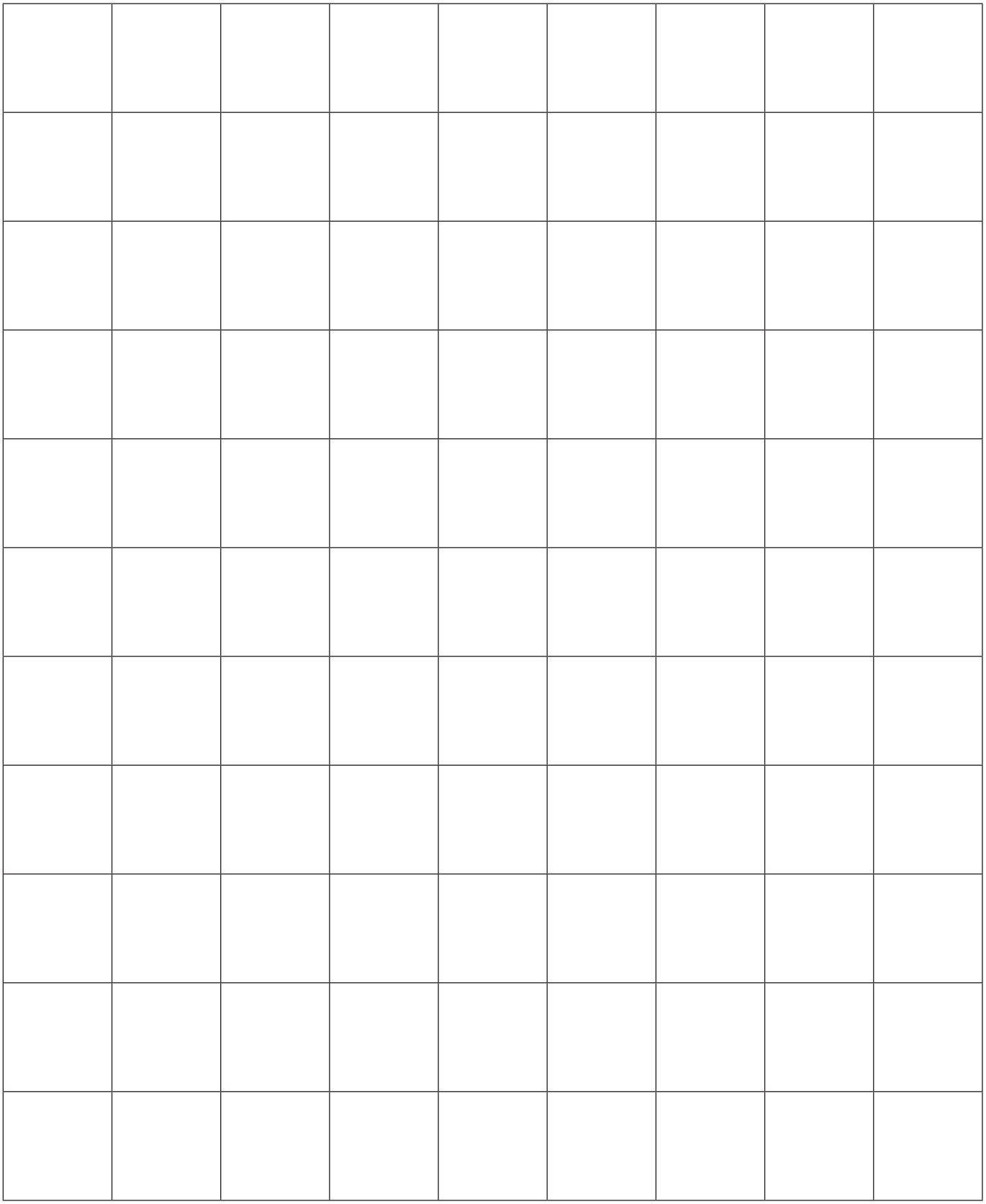
_____

_____

_____

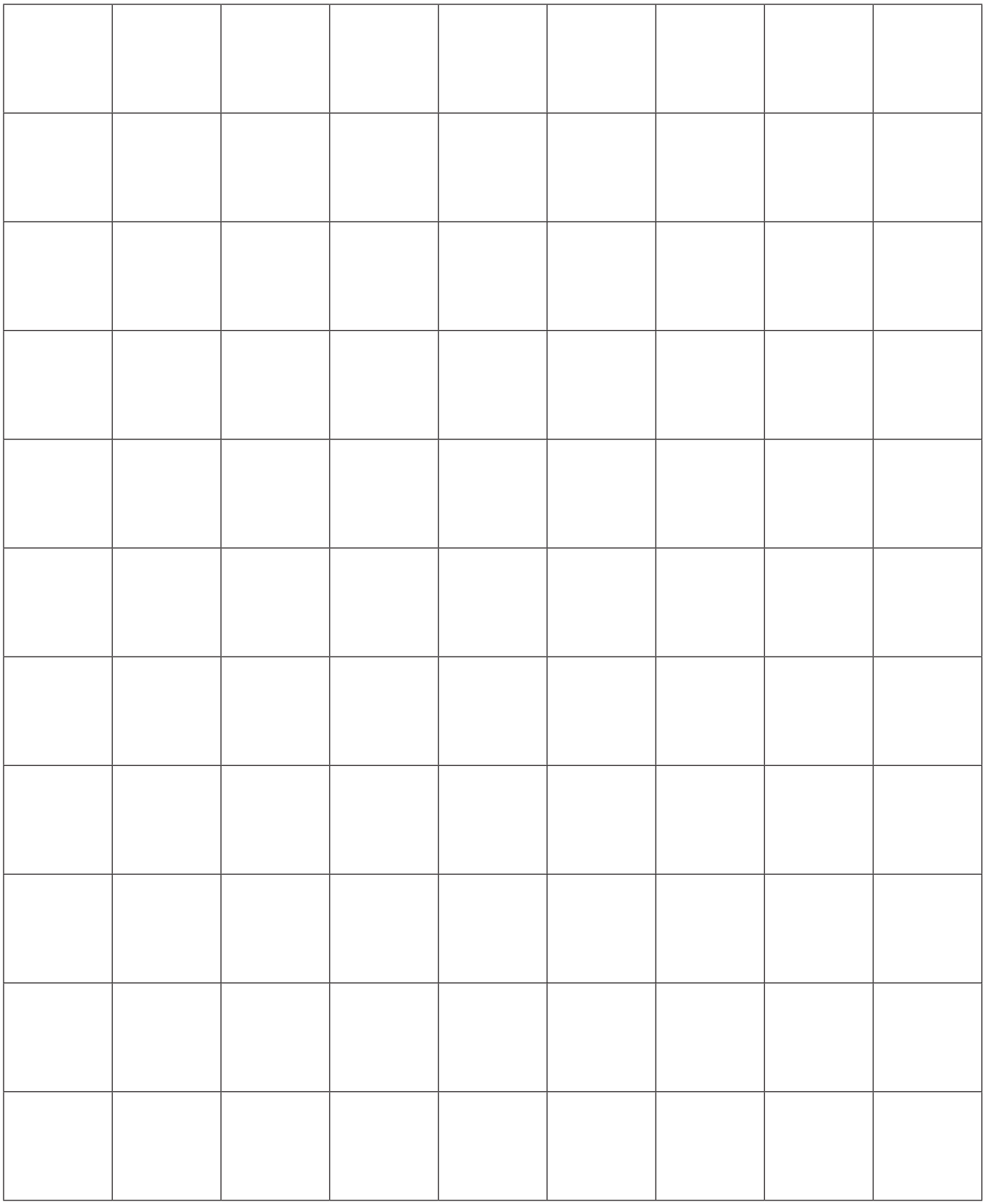
Name _____ Date _____

Two Centimeter Grid



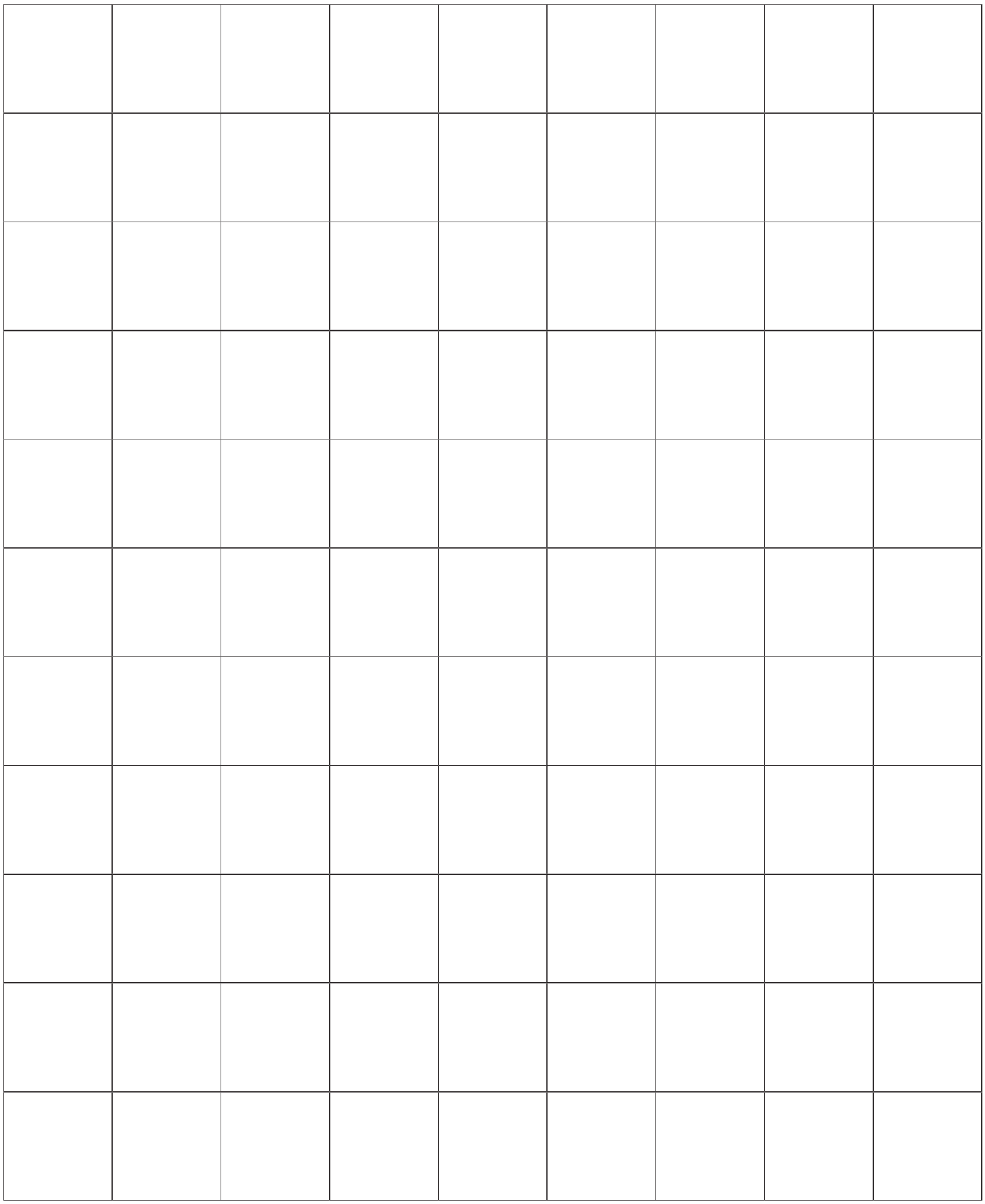
Name _____ Date _____

Two Centimeter Grid



Name _____ Date _____

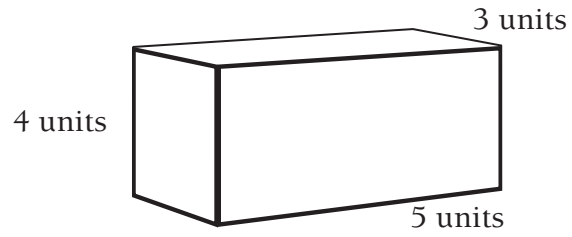
Two Centimeter Grid



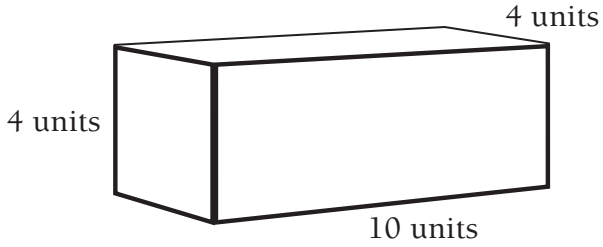
Which Box?

Find the volume of each box and then anwer the questions below.

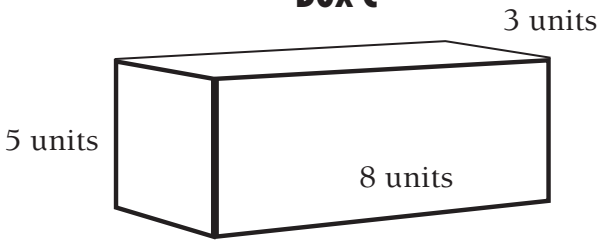
Box A



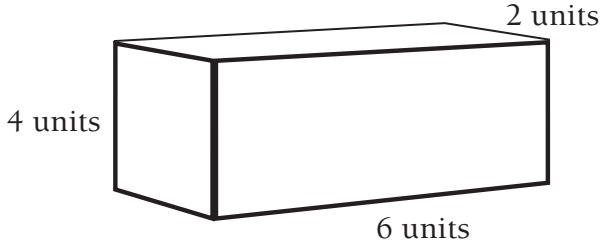
Box B



Box C



Box D



1. Emma needs a box that will hold all 48 of her wood blocks without any extra space. Each of her blocks is one cubic unit. Which box should she choose and why?

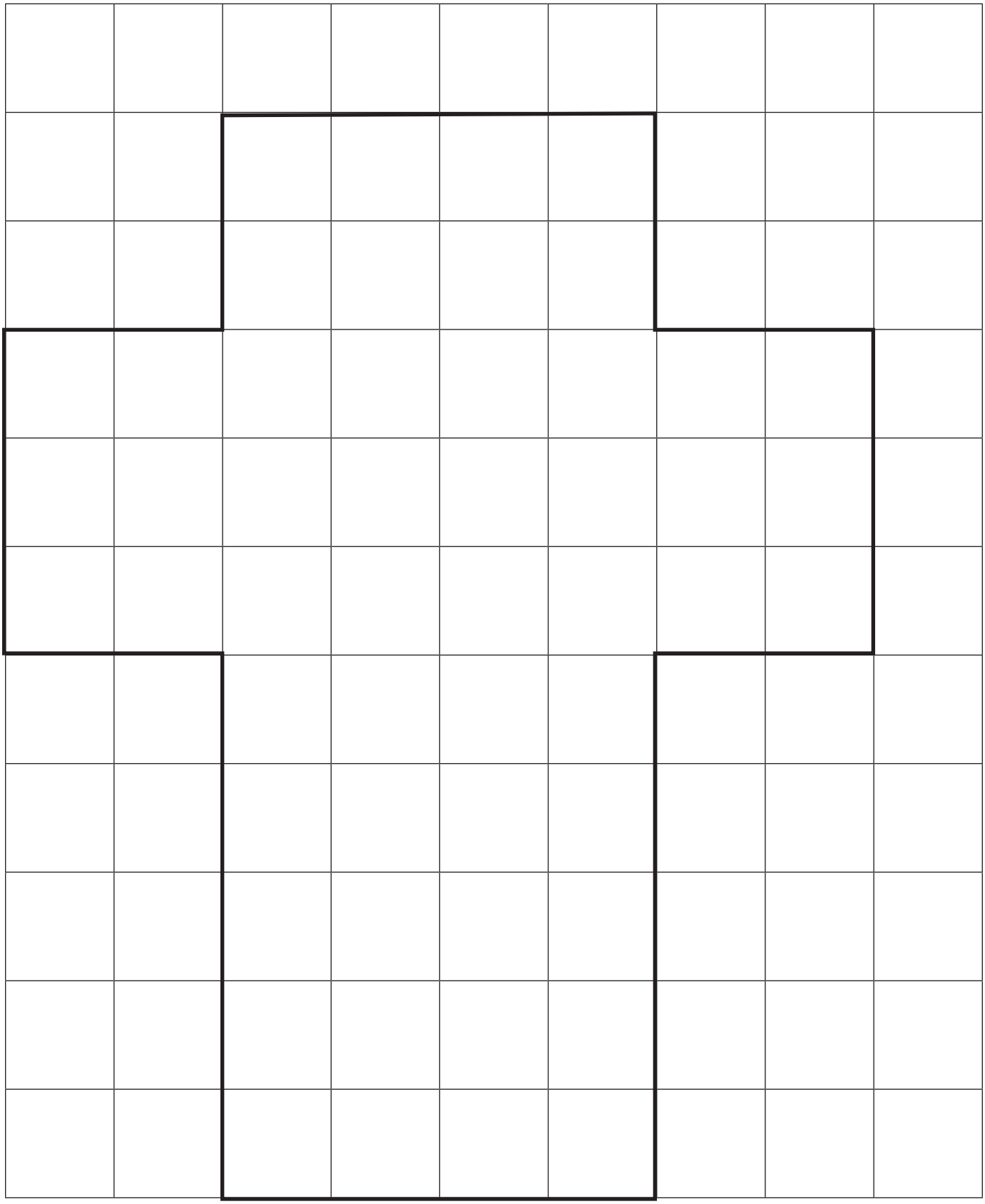
2. A toy company has to ship 80 yo yos. They put each yo yo in a small box that is two cubic units. Which box should they choose to ship 80 small boxes that are each two cubic units and explain your reasoning?

3. That same toy company now needs to ship 60 bouncy balls. They put each ball into a small box that is two cubic units. Which box should choose to ship 60 small boxes that are each two cubic units and explain your reasoning?

4. A candy company needs a box to pack 60 of their caramels. Each caramel is one cubic unit. Which box should they choose to pack their caramels if they do not want any extra space? Explain your reasoning.

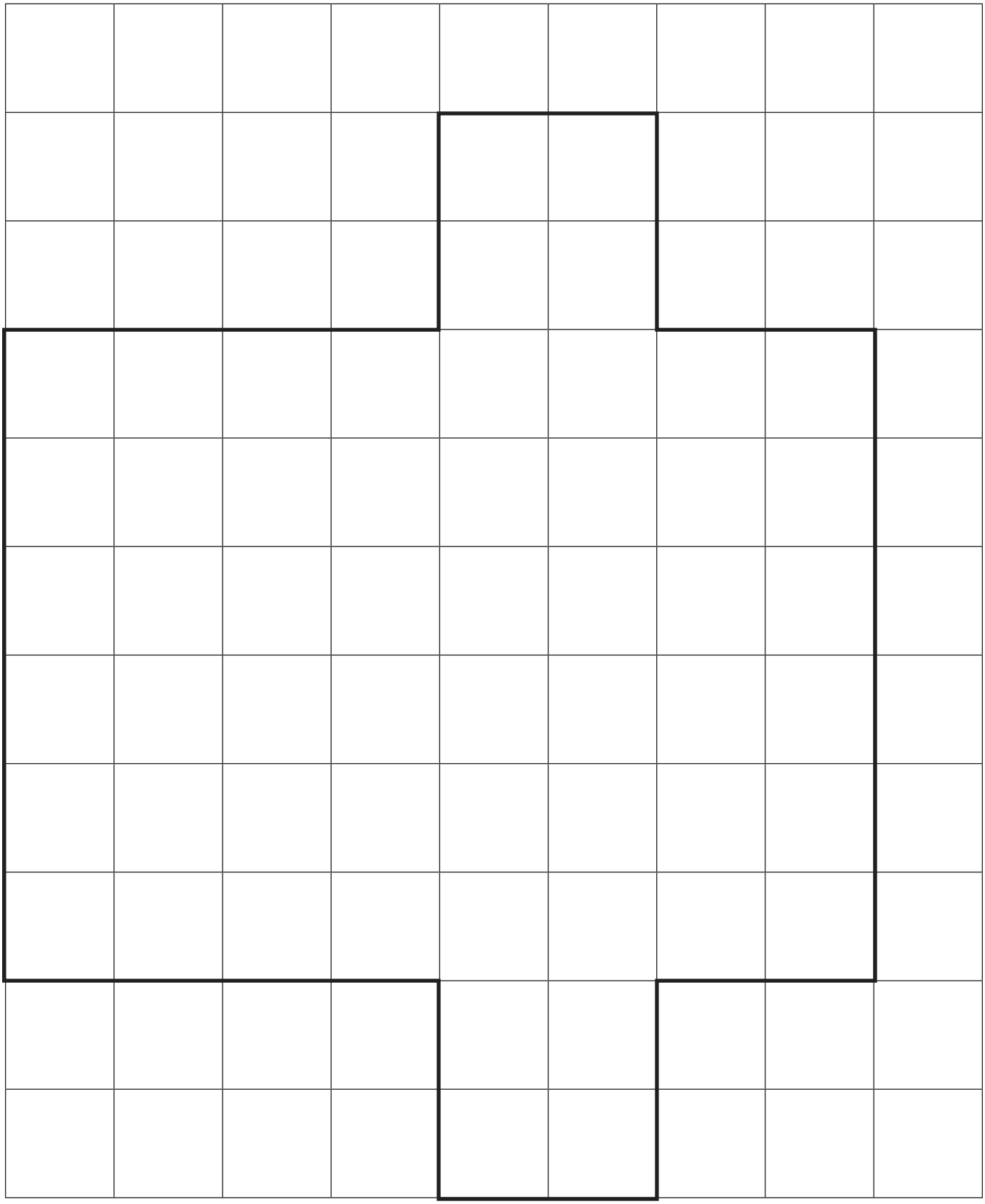
Name _____ Date _____

Net 1



Name _____ Date _____

Net 2



Candies R Us Box Designs

Using graph paper, make a net for each possible box. Cut it out, fold it and tape it into a box.

Dimensions of the box	Volume of the box	Sketch of a net of the box	Surface area of the box

Mixed-Up Pieces

You want to play a game with your family but all of the game pieces are mixed up. Use the clues below to figure out which game pieces go with each game.

1. A spinner is needed in the game box that has a surface area of 88 square units. What is the name of the game missing the spinner?

_____

2. A blue piece needs to be in the box with the smallest surface area. What game in is missing a blue piece?

_____

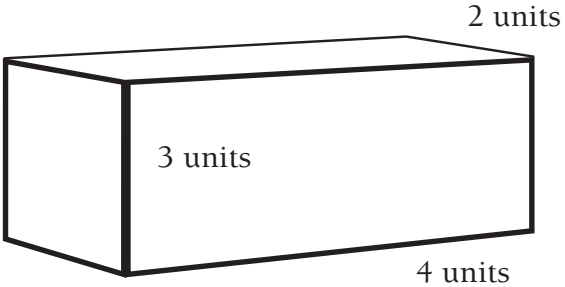
3. A dice is supposed to be in the game box that has the largest surface area. Which game is missing the dice?

_____

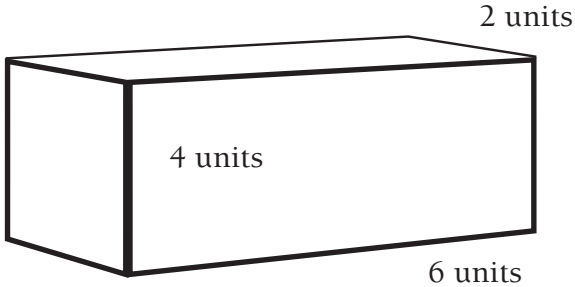
4. Two cards are needed to play the game that has the box with a surface area of 94 square units. What game is missing two cards?

_____

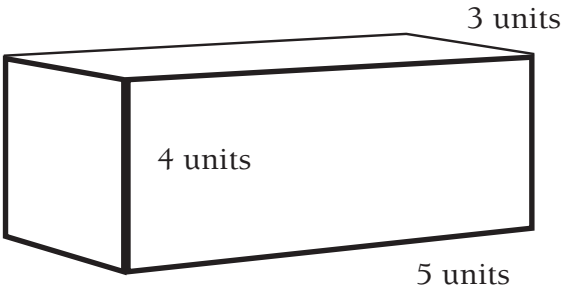
Whodunit?



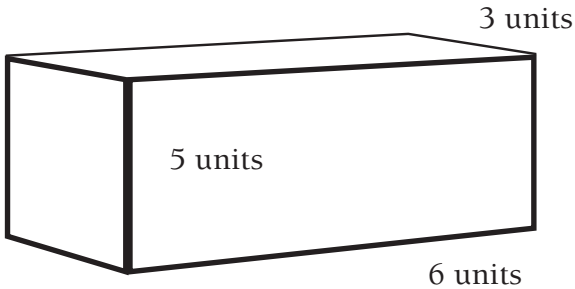
Hoppy Frogs



Jammin' Jane



Steps and Slides



Physical Change or Chemical Change

Everything that is made is either a physical change or a chemical change. Now that you have read about each of the products and written about how they were made by early colonists, make an educated guess whether you think the product is a physical change or chemical change and tell why you think this. (Some of them may involve both a physical change and chemical change in the process.)

1. Making Soap _____

_____

2. Making Bricks _____

_____

3. Making Candles _____

_____

4. Making Butter _____

_____

5. Making Bread _____

_____

6. Making Yarn _____

_____

Notes on Making _____

I. Write down the tools needed with their uses:

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

II. List of ingredients, their purposes, and their weights

a._____

b._____

c. _____

d._____

III. Write the steps needed to make the product. Write down any physical or chemical changes observed.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

IV. Uses of the product

_____ _____

_____ _____

_____ _____

_____ _____

V. Thoughts and discoveries while making the product

_____

_____

_____

_____

_____

VI. Chemical or Physical Change? Explain

_____

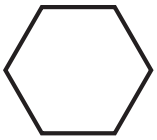
_____

_____

Utah Bakery Cakes

Here's something to think about . . .

The
Utah Bakery has
Come up with THE COOLEST specialty
cakes. They're triangular cakes.
Each triangular cake is made up of pieces with various flavors.
Every flavor is cut up in a different shape so the bakers can tell them apart.
Each flavor costs a different amount too. These are the shapes and their flavors:

Chocolate Mint 	**Strawberry** 
Blueberry 	**Lemon** 

1. For the triangular Specialty Cake the bakery includes at least two pieces of each kind of cake. It is the smallest cake you can make with at least 2 pieces of each kind of cake. Can you find a way to do that? What fractional value do each of the geometric shapes have? (Day #1)
2. For the Bargain Cake, they make a triangular cake (the same size as the specialty cake) as inexpensively as possible. The costs for the different flavors of cake are in the table below. What's the least expensive cake Orem Bakery can make?

$.50 Chocolate Mint	$1.00 Strawberry
$ .75 Blueberry	$1.75 Lemon

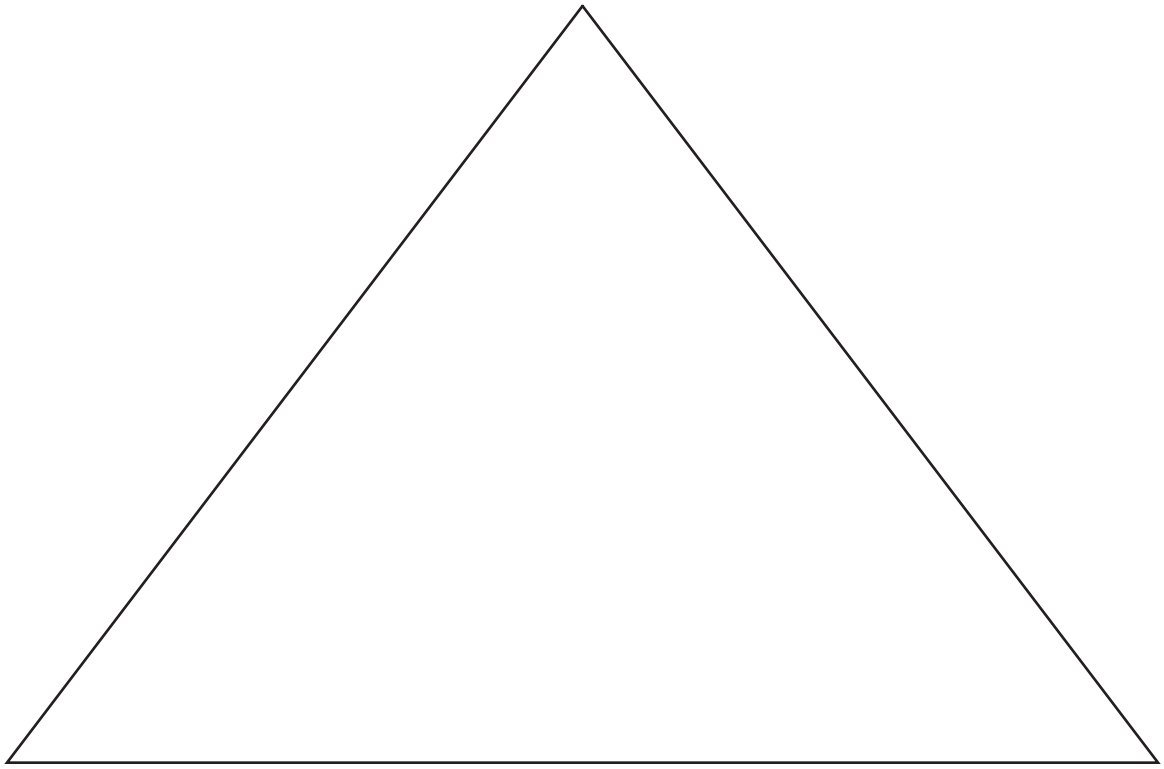
For each cake:

- Draw your design.
- Write a paragraph below your design explaining in detail the process you used and how you decided which pieces to use and well as what fractional value each geometric shape has. What patterns did you notices.

Name _____ Date _____

Specialty Cake

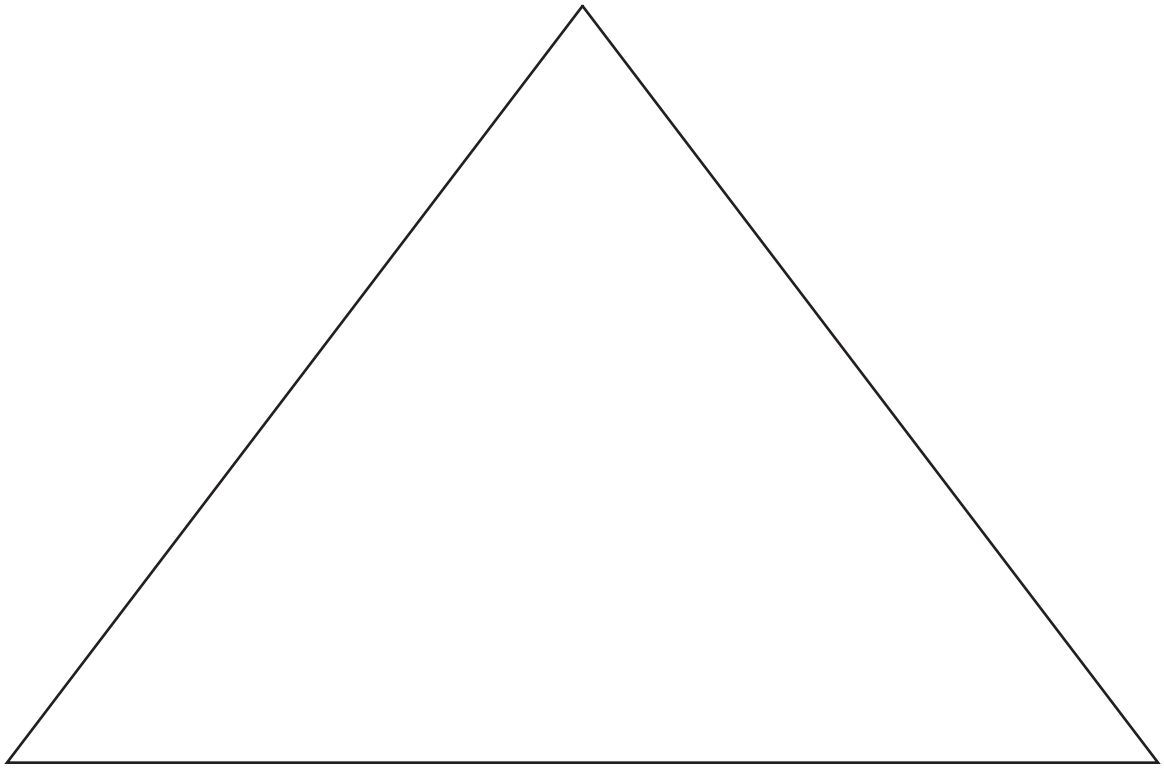
1. Design for the Specialty Cake (With at least two pieces of each kind of cake).



Name _____ Date _____

Bargain Cake

1. Design for the Bargaint Cake (With at least two pieces of each kind of cake).



Name _____ Date _____

Parts of a Dozen

1/3 = _____ 1/6 = _____

2/6 = _____ 2/3 = _____

1/2 = _____ 3/12 = _____

4/12 = _____ 9/12 = _____

8/12 =_____ 2/4 = _____

3/6 = _____ 4/6 = _____

1/4 = _____ 6/12 = _____

2/12 = _____ 3/4 = _____

Name _____ Date _____

Parts of a Dozen

1/3 = _____ 1/6 = _____

2/6 = _____ 2/3 = _____

1/2 = _____ 3/12 = _____

4/12 = _____ 9/12 = _____

8/12 =_____ 2/4 = _____

3/6 = _____ 4/6 = _____

1/4 = _____ 6/12 = _____

2/12 = _____ 3/4 = _____

One Grain, Two Grains, Four Grains...

As you listen to the story, try to use the doubling strategy to complete the following chart to determine the amount of rice Rani received each day.

Day 1 **1** grain of rice	Day 2 **2** grains of rice	Day 3 **4** grains of rice	Day 4 _____ grains of rice
Day 5 **16** grains of rice	Day 6 ____ grains of rice	Day 7 ____ grains of rice	Day 8 **128** grains of rice
Day 9 **256** grains of rice	Day 10 ____ grains of rice	Day 11 ____ grains of rice	Day 12 **2048** grains of rice
Day 13 **4096** grains of rice	Day 14 **8,192** grains of rice	Day 15 _____ grains of rice	Day 16 **32,786** grains of rice
Day 17 _____ grains of rice	Day 18 _____ grains of rice	Day 19 **262,144** grains of rice	Day 20 _____ grains of rice
Day 21 **1,048,576** grains of rice	Day 22 **2,097,152** grains of rice	Day 23 _____ grains of rice	Day 24 _____ grains of rice
Day 25 **16,777,216** grains of rice	Day 26 _____ grains of rice	Day 27 **67,108,864** grains of rice	Day 28 _____ grains of rice
Day 29 _____ grains of rice	Day 30 **536,870,912** grains of rice	Day 33 Extra Credit _____ grains of rice	Day 35 Extra Credit _____ grains of rice

Dinner is Served

course 1

leftovers

# of servings

Maitre d'

course 2

leftovers

# of servings

Maitre d'

course 3

leftovers

# of servings

Maitre d'

course 4

leftovers

# of servings

Maitre d'

course 5

leftovers

# of servings

Maitre d'

course 6

leftovers

# of servings

Maitre d'

Research Card

Name: _____

Location: _____

What geological feature is located here?

What geological processes have occurred here?

What do you think will happen in the next 100 years?

What do you think will happen in the next 10,000 years?

Research Card

Name: _____

Location: _____

What geological feature is located here?

What geological processes have occurred here?

What do you think will happen in the next 100 years?

What do you think will happen in the next 10,000 years?

Research Card

Name: _____

Location: _____

What geological feature is located here?

What geological processes have occurred here?

What do you think will happen in the next 100 years?

What do you think will happen in the next 10,000 years?

Research Card

Name: _____

Location: _____

What geological feature is located here?

What geological processes have occurred here?

What do you think will happen in the next 100 years?

What do you think will happen in the next 10,000 years?